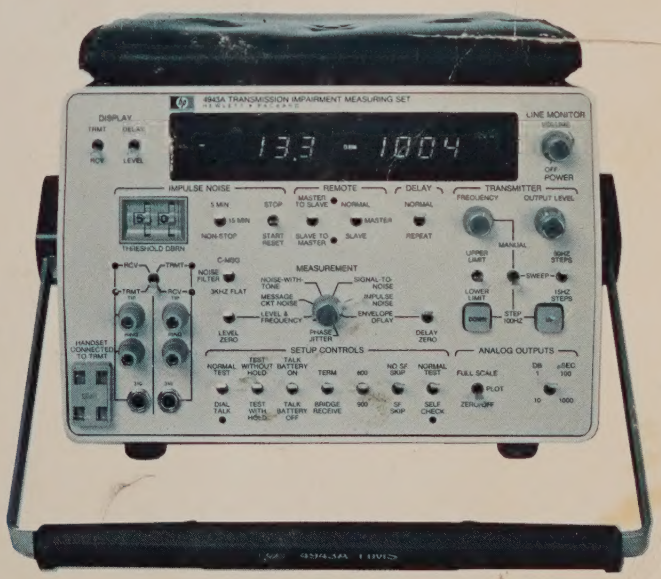
OPERATING AND SERVICE MANUAL

4943A

TRANSMISSION IMPAIRMENT MEASURING SET

INSTRUMENT SHOP



HEWLETT PACKARD

SAFETY

This product has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the product safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section I for general safety considerations applicable to this product.

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard product is warranted against defects in material and workmanship for a period of one year from date of shipment [, except that in the case of certain components listed in Section I of this manual, the warranty shall be for the specified period] [1]. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

HEWLETT PACKARD

MANUAL CHANGES

------ MANUAL DESCRIPTION ------

INSTRUMENT: 4943A

SERIAL PREFIX: 2015A

DATE PRINTED: APRIL 1981

HP PART NO: 04943-90002

MICROFICHE NO: 04943-90003

CHANGE DATE 17 MARCH 1982

(This change supersedes all earlier dated changes)

* Make all changes listed as ERRATA.

* Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

If your Instrument has serial prefix or serial number	Make these changes to your manual	If your instrument has serial prefix or serial number	Make these changes to your manual
2210A and below	1		

ERRATA

Page 4-5, Paragraph 4-11. Harmonic Distortion, Spurious Signals, and Background Noise Test

Change Step 2 of the procedure to read:

2. Set spectrum analyzer to sweep the frequency range from 0-10 kHz. The fundamental at 1004 Hz will be accompanied by 83 Hz sidebands(at 921 Hz and 1087 Hz), which will be 11.2 - 12.9 dB down. The signals at 83 Hz and 3095 Hz should be 52 dB below the fundamental level. All other harmonics and spurious signals must be at least 46 dB below the fundamental. Particular frequencies to measure are 166 Hz, 2008 Hz,3012 Hz, and 5020 Hz.

Page 5-24, Paragraph 5-30. Nonlinear Distortion Transmitter Adjustment (opt 012)

Change Step 3 of the procedure to read:

3. Connect AC DVM to A22U16 pin 1(HI) and Chassis(LO). Verify AC DVM reading of 550+-45mVac.

Page 6-3, Table 6-2. Reference Designations and Abbreviation (1 of 2)

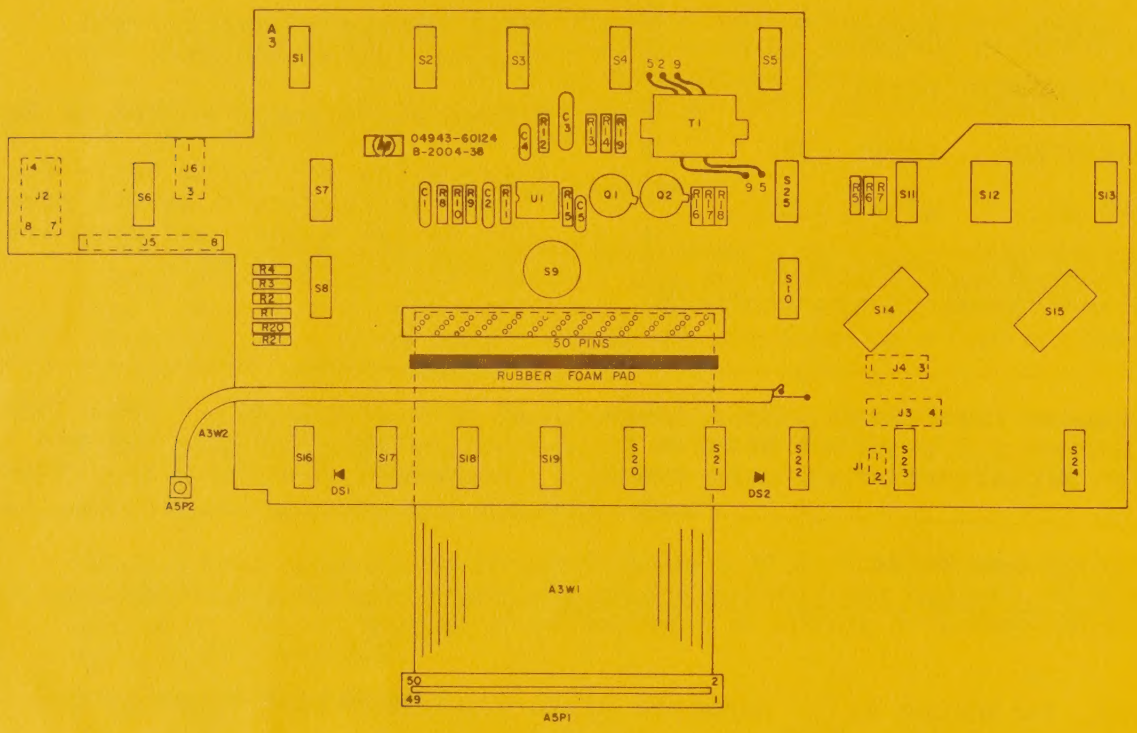
Add the following to REFERENCE DESIGNATIONS:

H = Hardware

MP = Mechancial Parts

Page 6-45, Table 6-3. Replaceable Parts (45 of 51)
Delete: 5 HP 0370-0963, KNOB-FINE
Add: 5 HP 0370-3042, KNOB-BASE-CONC 1/2 JGK .127-IN-ID

Page 8-52, Figure 8-29. A3 Switch Component Locator
Replace as shown below:

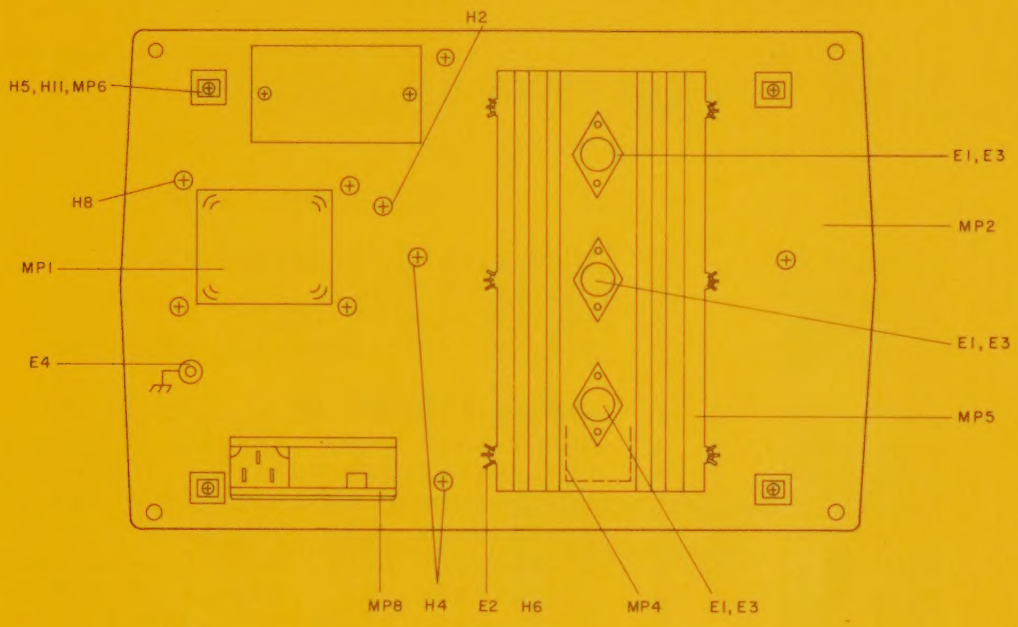


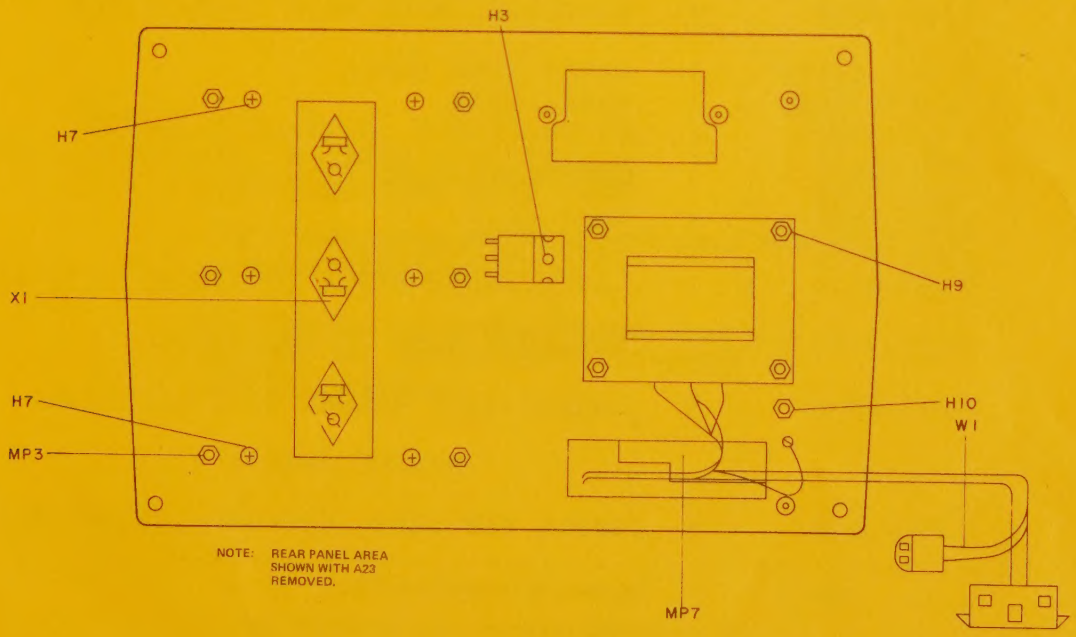
CHANGE 1

Page 6-40, Table 6-3. Replaceable Parts (36 of 51)
Change: Quantity for A23R8 HP 0757-0280, RESISTOR from 3 to 1
Delete: A23R14 HP 0757-0280, RF 1K 1% .125W
Delete: A23R35 HP 0757-0280, RF 1K 1% .125W
Add: A23R14 HP 0757-0416, RF 511 1% .125W
Add: A23R35 HP 0757-0274, RF 1.21K 1% .125W

CHANGE 1(cont'd)

Page 6-50, Table 6-3. Replaceable Parts(46 of 51)
Replace as shown below:





CHANGE 1(cont'd)

Page 6-51, Table 6-3. Replaceable Parts (47 of 51)
Replace as shown below:

Table 6-3. Replaceable Parts (47 of 51)

REFERENCE DESIGNATOR	HP PART NUMBER	QTY	DESCRIPTION
			REAR PANEL AREA
E1	0340-0417	3	INSULATOR-XSTR THERMA-FILM
E2	0340-0832	6	INSULATOR NYLON
E3	0340-0833	3	INSULATOR-XSTR POLYE
E4	1510-0038	1	BINDING POST ASSY SGL THD-STUD
H1	2190-0046	6	WASHER-LK HLCL NO.6 .141-IN-ID
H2	2200-0105	1	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI
H3	2260-0009	1	NUT-HEX W/LKWR 4-40-THD .094-IN-THK
H4	2360-0115	10	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI
H5	2360-0125	4	SCREW-MACH 6-32 .75-IN-LG PAN-HD-POZI
H6	2360-0201	6	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI
H7	2510-0051	6	SCREW-MACH 8-32 .625-IN-LG PAN-HD-POZI
H8	2680-0071	6	SCREW-MACH 10-32 1.75-IN-LG PAN-HD-POZI
H9	2740-0006	6	NUT-HEX-W/LKWR 10-32-THD .125-IN-THK
H10	2950-0006	1	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK
H11	3050-0010	4	WASHER-FL MTLC NO.6 .147-IN-THK
MP1	01710-04103	1	COVER,XFMR SHELL
MP2	04943-00020	1	PANEL-REAR
MP3	0380-0093	6	STANDOFF-HEX .5-IN-LG 6-32-THD
MP4	0905-0687	1	GASKET RECT NPRN-FM .312-THK 5.8-LG
MP5	1205-0299	1	HEAT SINK SPCL-HOLE-PATT
MP6	5040-7829	1	FOOT-REAR
MP7	5950-3816	1	LABEL,HI-VOLTAGE
MP8	7120-4119	1	LABEL,INFORMATION .21-IN-WD .233-IN-LG
W1	8120-2471	1	FAN CORD ASSY 18-AWG 2-COND
X1	1200-0536	3	SOCKET-XSTR 3-CONT TO-3 SLDR-EYE
			MISCELLANEOUS
	1400-0249	5	CABLE TIE .062-.625-DIA .091-WD NYL

HEWLETT PACKARD

OPERATING AND SERVICE MANUAL

4943A

TRANSMISSION IMPAIRMENT MEASURING SET
(Including Options 010, 012, 015, 019 & 910)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2015A.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

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5070 CENTENNIAL BLVD., COLORADO SPRINGS, CO 80919

MANUAL PART NO.: 04943-90002
Microfiche Part No.: 04943-90003

Reprinted: JAN 1982
Revised APR 1981

WARNING

SAFETY

If this instrument is to be energized via an autotransformer for voltage reduction, make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

GROUNDING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

HIGH VOLTAGE

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Adjustments and service described herein are performed with power supplied to the instrument while protective covers are removed. Energy available at many points, if contacted, result in personal injury.

CAUTION

LINE VOLTAGE

BEFORE SWITCHING ON THIS INSTRUMENT, make sure instrument requirements match the voltage of the power source.

GROUNDING

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that all devices connected to this instrument are connected to the protective (earth) ground.

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

IEC SYMBOLS

The following is a list of key IEC symbols used by Hewlett-Packard. All symbols are normally applied adjacent to the device requiring the symbol. They shall not be placed on removable parts likely to be detached or lost.

Instruction Manual symbol: If necessary, to preserve the apparatus from damage it is necessary for the user to refer to the instruction manual, then shall the apparatus be marked with this symbol (IEC 348;16a).

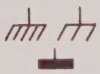
Terminal devices fed from the interior by live voltages that may be dangerous when connecting to or disconnecting from those devices shall be marked with the flash shown when the voltage exceeds 1 KV: The flash shall be red (IEC 348;18c).

Earth Terminals. If the use of this symbol for the protective earth terminal is not permitted by National Standards, it may be modified, for example, by being placed inside a circle (IEC 348;18a).

AC current (IEC 117-1, symbol No. 3).

DC current (IEC 117-1, symbol No. 2).

AC or DC current (IEC 117-1, symbol No. 8).



Frame or chassis connection. The hatching may be completely or partly omitted if there is no ambiguity. If the hatching is omitted, the line representing the frame or chassis shall be thicker (IEC 117-1, symbol No. 87).

A Ampere (IEC 117-4, symbol No. 356).

V Volt (IEC 117-4, symbol No. 357).

VA Voltampere (IEC 117-4, symbol No. 358).

W Watt (IEC 117-4, symbol No. 360).

Wh Watthour (IEC 117-4, symbol No. 361).

VAh Voltamperehour (IEC 117-4, symbol No. 362).

Hz Hertz (IEC 117-4, symbol No. 365).

Contactor, normally closed. In order to avoid confusion with the symbol for a capacitor, the distance between the horizontal (as drawn here) lines should be at least equal to the length of those lines (IEC 117-3, symbol No. 215.2).

In addition the following describes the use of Warnings, Cautions and Notes used in HP Automatic Test System Manuals.

Warnings, cautions and notes. (All) Warnings and cautions shall precede the text to which each applies but notes may precede or follow applicable text depending on the material to be highlighted. Warnings, cautions, and notes shall not contain procedural steps nor shall they be numbered. When a warning, caution, or note consists of two or more paragraphs, the heading WARNING, CAUTION, NOTE, shall not be repeated above each paragraph. If it is ever necessary to precede a paragraph by both a warning and a note, or a caution and a note, etc, they shall appear in the sequence as noted, namely, warnings, cautions, notes. Such inserts in the text shall be short and concise and be used to emphasize important and critical instructions.

WARNING

An operating procedure, practice, etc, which, if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc. which, if not strictly observed, could result in damage to, or destruction of, equipment.

NOTE: An operating procedure, condition, etc. which it is essential to highlight.

Health hazards precaution data. (All) When hazardous chemicals or adverse health factors, in the environment or use of the equipment cannot be eliminated, appropriate precautionary requirements shall be included.

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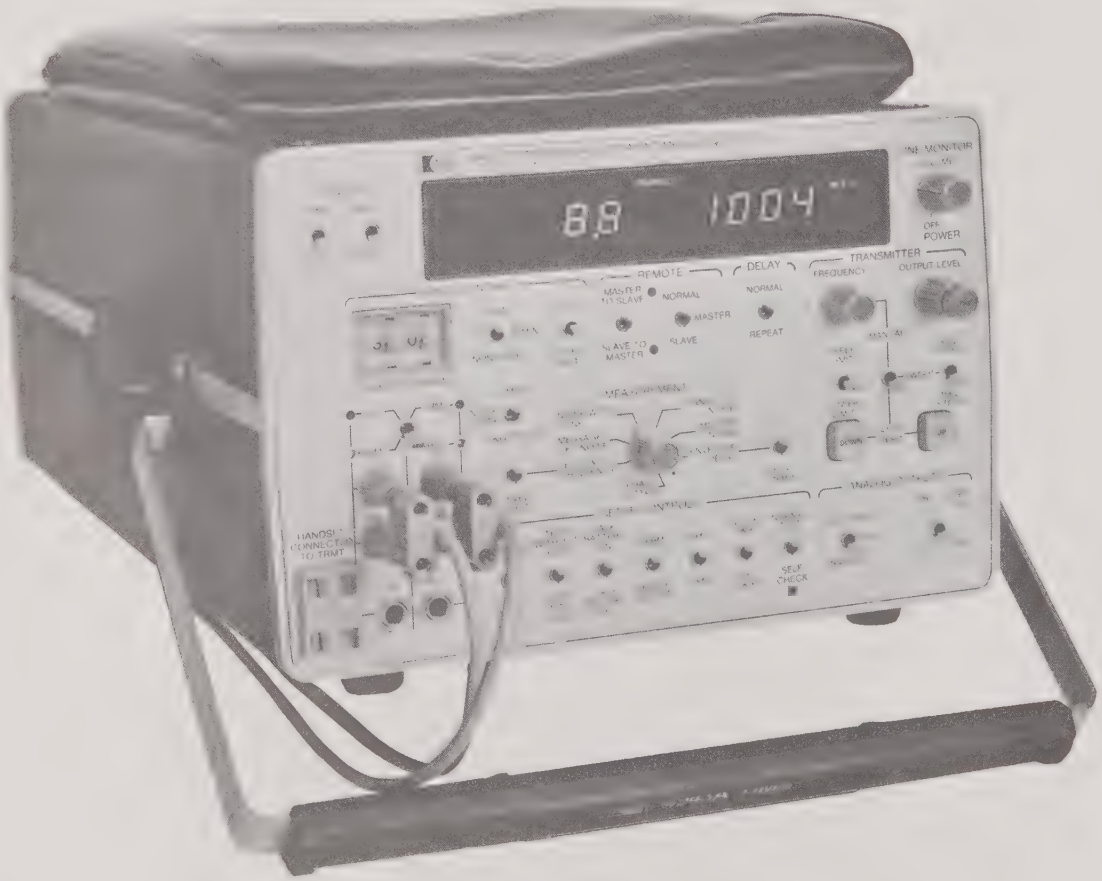


Figure 1-1. Hewlett-Packard Model 4943A Transmission Impairment Measuring Set

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 4943A Transmission Impairment Measuring Set. Figure 1-1 shows the instrument with its front cover removed.

1-3. Also listed on the title page of this manual is a microfiche part number. This number can be used to order 4 x 6-inch microfilm transparencies of this manual. Each microfiche contains up to 96 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement.

1-4. SPECIFICATIONS

1-5. Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested.

1-6. INSTRUMENTS COVERED BY MANUAL

1-7. Attached to the instrument is a serial number plate. The serial number is in the form: 0000A-00000. It is in two parts; the first four digits and the letter are the serial prefix and the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-8. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-9. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-10. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-11. DESCRIPTION

1-12. The Hewlett-Packard Model 4943A is a combination test set used by the telephone industry. The unit is used for measuring analog parameters on voice bandwidth data circuits. The parameters measured are (1) loss, (2) message circuit noise, (3) noise-with-tone, (4) signal-to-noise ratio, (5) impulse noise, (6) envelope delay distortion, and (7) phase jitter. The 4943A also includes a comprehensive self-check capability.

1-13. The 4943A incorporates master-slave provisions for use on 4-wire circuits. Measurement control for both directions of transmission is at one end of the circuit. At the control end is the master unit. At the remotely controlled end is the slave unit. All test results for both directions are displayed at the master unit. Choice of the direction of test (i.e., master-to-slave or slave-to-master) is by switch selection at the master unit.

1-14. The slave unit requires a simple setup and then may be left unattended. Every Model 4943A may be used as the controlling master or remotely controlled slave. Selection of function is by front panel switch.

1-15. OPTIONS

1-16. Options are modifications or additions to a standard unit that are requested by the customer. Available options are:

a. Option 010. Adds Hewlett-Packard Interface Bus (HP-IB) capability. HP-IB allows calculator or computer control of most measurement functions. Includes one 18061A Analog Output Adapter Cable.

b. Option 012. Replaces phase jitter measurement with nonlinear distortion measurement. This option is completely documented in this manual.

c. Option 015. Adds Model 18055A Transit Case. Provides additional protection for unit during shipment.

d. Option 019. Adds Model 10491B Rack Mount Adapter. Allows mounting in a 19 inch relay rack.

e. Option 910. Provides an additional set of manuals.

1-17. RECOMMENDED TEST EQUIPMENT

1-18. Equipment required to maintain the Model 4943A is listed in Table 1-2. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

1-19. OPERATING INSTRUCTIONS BOOKLET

1-20. Separate operating instructions are provided in the 4943A Operating Instructions booklet, HP P/N 04943-90001. This manual provides for complete operation of all features except HP-IB. Remote HP-IB operation is covered in a separate operating note. Each operating note is tailored to a specific controller (such as 9825A).

Table 1-1. Specifications (1 of 4)

Transmitter	Receiver
Level and Frequency Frequency Range: 200Hz to 3950 Hz Resolution: 1 Hz Accuracy: ±0.5 Hz Manual Mode: Continuously adjustable 200 Hz to 3950 Hz Step 100 Hz Mode: 204 Hz to 3904 Hz in 100 Hz increments Level Range: +10 dBm to −40 dBm Resolution: 0.1 dBm Accuracy: ±0.1 dB Frequency Response: ±0.1 dB from 200 Hz to 3904 Hz Harmonic and Spurious Signals Total Harmonic Distortion to 10 kHz: Greater than 50 dB below fundamental Spurious Signals to 10 kHz: Greater than 50 dB below fundamental Background Noise to 10 kHz: Less than −90 dBm	Frequency Range: 200 Hz to 4100 Hz Resolution: 1 Hz Accuracy: ±0.5 Hz Level Range: +10 dBm to −69.9 dBm Resolution: 0.1 dBm Accuracy: Level Range — Accuracy at 1 kHz > 0 dBm — ±0.2 dB 0 dBm to −19 dBm — ±0.1 dB −19.1 dBm to −40 dBm — ±0.2 dB < −40 dBm — ±0.5 dB Detector: Full wave average Bandwidth (3dB points): Nominal 20 Hz to 10 kHz

Table 1-1. Specifications (2 of 4)

Transmitter	Receiver
Message Circuit Noise Quiet Termination: 600Ω or 900Ω	Weighting Filter: C-Message or 3 kHz Flat Detector: Quasi RMS Range: +20 dBrn to +90 dBrn Resolution: 1 dBrn Accuracy: ±1 dB
Noise-With-Tone Frequency: 1004 Hz fixed Level Range: +10 dBm to –40 dBm Resolution: 1 dBm Background Noise, Harmonics and Spurious Signals: Refer to LEVEL AND FREQUENCY	Notch Filter: Greater than 50 dB rejection from 995 Hz to 1025 Hz Other Specifications: Refer to MESSAGE CIRCUIT NOISE
Signal To Noise Ratio* Frequency: 1004 Hz fixed Level Range: +10 dBm to –40 dBM Resolution: 1 dBm Background Noise, Harmonics and Spurious Signals: Refer to LEVEL AND FREQUENCY *Signal Plus Noise to Noise Ratio	Weighting Filter: C-Message or 3 kHz Flat Detector: Quasi RMS Range: 10 dB to greater than 50 dB Resolution: 1 dB Accuracy: ±1 dBm
Impulse Noise Frequency: 1004 Hz fixed Level Range: +10 dBm to –40 dBm Resolution: 1 dBm Background Noise, Harmonics and Spurious Signals: Refer to LEVEL AND FREQUENCY	Received Tone Level: 0 dBm to –40 dBm Notch Filter: Greater than 50 dB rejection from 995 Hz to 1025 Hz Impulse Noise Threshold Range: 30 dBrn to 109 dBrn Impulse Noise Threshold Accuracy: ±1 dB Impulse Noise Count Range: 0 to 9,999 Count Rate: 7 counts per second max. ±5% Count Interval: 5 minute, 15 minute, or non-stop Digital Timer: Displays minutes remaining for timed intervals; displays minutes elapsed for non-stop counting. Loss of Holding Tone Indication: Minus sign appears in left hand display when holding tone drops below –40 dBm +0 dB –5 dB, for greater than 1 second.
Envelope Delay Frequency Range: 200 Hz to 3904 Hz Other Frequency Specifications: Refer to LEVEL AND FREQUENCY Modulation Frequency: 83 1/3 Hz Level Range: +10 dBm to –40 dBm Other Level Specifications: Refer to LEVEL AND FREQUENCY Harmonic and Spurious Signals to 10 kHz: 83 1/3 Hz and 3 ($f_{carrier}$)+83 1/3 Hz greater than 52 dB below main signal power. All other signals greater than 46 dB below main signal power. Background Noise to 10 kHz: Less than –90 dBm	Frequency Range: 300 Hz to 3904 Hz Other Frequency Specifications: Refer to LEVEL AND FREQUENCY Level Range: +10 dBm to –40 dBm Carrier Level Accuracy ±0.25 dB Other Level Specifications see LEVEL AND FREQUENCY Delay Range: –3,000 μs to 9,000 μs Resolution: 1μs Accuracy (back to back): ±10 μs from 600 Hz to 3904 Hz; ±30 μs from 300 Hz to 600 Hz Minimum Signal to Noise Ratio (for stated accuracy): 20 dB, 3 kHz flat weighting

Table 1-1. Specifications (3 of 4)

Transmitter	Receiver
Phase Jitter Frequency: 1004 Hz fixed Level Range: +10 dBm to –40 dBm Resolution: 1 dBm Background Noise, Harmonics and Spurious Signals: Refer to LEVEL AND FREQUENCY	Frequency Range: 990 Hz to 1030 Hz Level Range: +10 dBm to –40 dBm Jitter Range: 0.2 to 30 degrees Resolution: 0.1 degree Accuracy: ±5% of reading ±0.2 degree Detector: Peak to peak Bandwidth (3dB points): Nominal 20 Hz to 300 Hz
Miscellaneous Longitudinal Balance: 60 dB to 6 kHz, decreasing 6 dB per octave above 6 kHz Impedances: 600Ω and 900Ω nominal Return Loss: Greater than 40 dB SF Skip: 2450 Hz to 2750 Hz	Longitudinal Balance: 60 dB to 6 kHz, decreasing 6 dB per octave above 6 kHz Terminating Impedances: 600Ω and 900Ω Bridging Impedance: Greater than 45 K Ω Bridging Loss: Less than 0.3 dB at 1 kHz Return Loss; Greater than 40 dB High Frequency Protection: Greater than 60 dB attenuation above 500 kHz
OPTION 012 INSTRUMENT (DELETES PHASE JITTER – ADDS NONLINEAR DISTORTION)	
Transmitter	**Receiver**
Nonlinear Distortion Test Signal Type: Four equal level tones. Two tones 6 Hz apart centered at 860 Hz and two tones 16 Hz apart centered at 1380 Hz. Level Range: 0 dBm to –40 dBm Resolution: 1 dBm Harmonic Distortion: Any harmonic of any of the four tones is greater than 40 dB below the tone.	Level Range: 0 dBm to –40 dBm Resolution: 1 dBm Accuracy: ±1 dBm 2nd Order Receive Filters: Centered at 520 Hz & 2240 Hz 3rd Order Receive Filter: Centered at 1900 Hz 2nd and 3rd Order Products: Range: To 55 dB below received level Accuracy: ±1 dB For Input Level Range of –5 dBm to –25 dBm 2nd Order Range: To 70 dB below received level 3rd Order Range: To 75 dB below received level

Table 1-1. Specifications (4 of 4)

Test Jacks: 310 jacks and 5-way binding posts for both transmitter and receiver.
DC blocking (with no holding): 200 volts

Power Requirements: 100, 120, 220, 240 Vac; −10%, +5%; 48 to 66 Hz, 60 VA

Operating Temperature: 0°C to 55°C (32°F to 131°F)

Storage Temperature: −40°C to 75°C (−40°F to 167°F)

Weight: Net 12.2 kg (27 lb.); shipping 21.4 kg (47 lb.)

Dimensions:

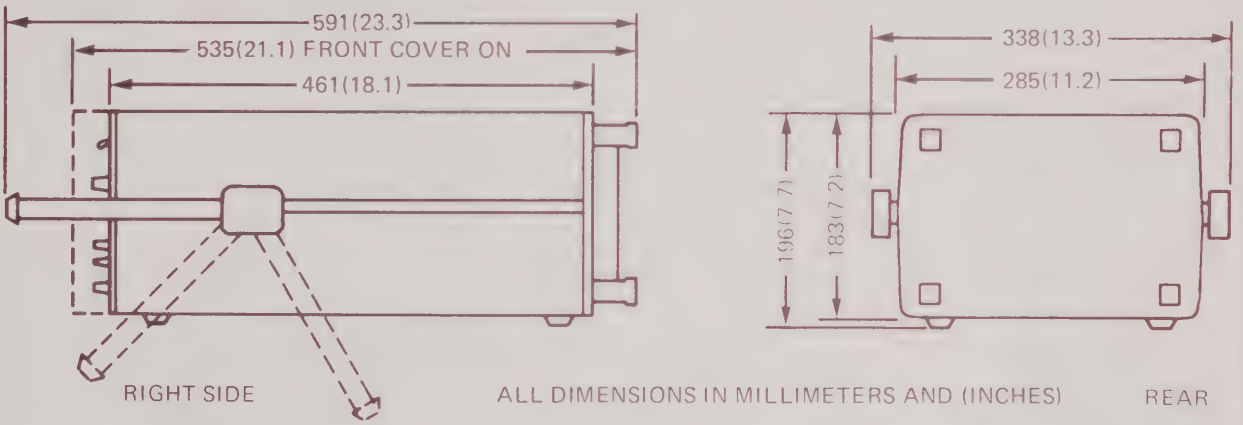


Table 1-2. Recommended Test Equipment

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED MODEL	USE*
AC Calibrator[1]	Amplitude Accuracy: ±0.1% Impedance: 600 ohms	HP 745A	P,A,T
Audio Oscillator[2]	Impedance: 600 ohms	HP 200CD	P,A,T
AC/DC Digital Voltmeter[3]	AC Measurement: True RMS Accuracy: ±0.01%	HP 3480A/B/C/D	P,A,T
DC Milliammeter	Range: 0-40 mA	HP 428A/B	P,A,T
DC Power Supply	Voltage: 0–>50 Vdc	HP 6217A	P,A,T
Frequency Counter	Frequency Range: 50 Hz–10 MHz	HP 5381A	P,A,T
Oscilloscope[4]	Bandwidth: >500 kHz Mode: Capability of A vs. B	HP 1200A/B	A,T
Spectrum Analyzer[5]	Frequency Range: 50 Hz–50 kHz Bandwidth (min.): 50 Hz	HP 3580A/3581A	P,A,T
Variable AC Transformer	Voltage Output: 90–130 Vac Current Capability: 2A		A,T
Resistor	600 ohm, 0.5%, 1/4W	HP P/N 0698-6261	P,A,T
Potentiometer	2000 ohm, 2W	HP P/N 2100-2729	A,T
Extender Board	44 pin	HP P/N 04942-60036	A,T
Extender Board	86 pin	HP P/N 04942-60035	T
Signature Analyzer		HP 5004A	T
HP-IB Bus System Analyzer[6]	Capable of exercising another talker, listener, or controller.	HP 59401A	T

*P = Performance Test, A = Adjustments, T = Troubleshooting.

NOTES:
[1]If AC Calibrator is not available, it is possible to use an audio oscillator and AC DVM. The oscillator must be capable of producing frequencies between 150 Hz and 5 kHz, at an amplitude of 2.5 VRMS into 600 ohms.

[2]Used for phase jitter only.

[3]The AC DVM needs true RMS capability only for noise-related measurements. For all other measurements, an average-reading AC DVM is sufficient.

[4]If oscilloscope with A vs. B capability is not available, it is possible to use an oscilloscope with EXT HORIZONTAL input, with as much sensitivity as possible. Do not use any amplifier which might distort the phase of the incoming signal.

[5]If spectrum analyzer is not available, it is possible to use a wave analyzer, or other frequency-selective voltmeter. A distortion analyzer measuring total harmonic distortion is not usable.

[6]Used only for HP-IB service.

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information on unpacking and incoming inspection, power requirements, mounting, checkout, and packing and shipping for the Model 4943A Transmission Impairment Measuring Set.

2-3. UNPACKING AND INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the unit has been checked mechanically and electrically. Procedures for checking electrical performance are given in paragraph 2-15. If the contents are incomplete, if there is mechanical damage or defect, or if the unit does not pass the electrical performance test, notify the nearest Hewlett-Packard office (listed in the back of this manual). If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. POWER REQUIREMENTS

2-6. The test set operates on standard commercial power of 100, 120, 220, or 240 Vac; –10% to +5%. The needed power source frequency is between 48 and 66 Hz, at 60 VA.

2-7. LINE VOLTAGE SELECTION

CAUTION

To prevent damage to the instrument, make the voltage selection BEFORE connecting the line power. Also ensure the line power cord is connected to a line power socket that is provided with a protective earth contact.

2-8. A rear panel, line power module permits operation from various line voltages. The number visible through the window (located on the module) indicates the nominal line voltage. The proper line voltage may have been selected at the factory.

2-9. The line module is shown in Figure 2-1. The procedure steps in this figure explain how to change the line voltage selection.

NOTE

The correct fuse rating for the line voltage selected is listed on the instrument rear panel. A complete set of fuses is supplied with the instrument.

2-10. POWER CORD

2-11. To protect operating personnel, the test set panel and chassis must be grounded. This test set is equipped with a detachable three-conductor power cable (HP P/N 8120-2220) which, when connected to a properly grounded power receptacle, grounds the unit.

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

2-12. MOUNTING

2-13. The standard 4943A is provided with plastic feet on the bottom and back. This allows placement on any flat surface. If it is desired to rack mount the test set, then Option 019 may be ordered at the time of purchase (includes Model 10491B Rack Mount Adapter). To add rack mount capability after purchase, then Model 10491B may be ordered separately.

2-14. The test set is air cooled with ventilation holes on the sides and bottom. The power supply, located at the back of the unit, has cooling fins exposed. These fins provide convection cooling for the power supply circuitry.

CAUTION

The test set must have free air flow around all surfaces to prevent overheating. Do not block ventilation holes, or place the test set on top of heat generating equipment.

2-15. BEFORE-USE CHECKOUT

2-16. To determine that the test set is electrically operational, perform the Self Check procedures as described in the Operation section of this manual. The self check procedures will determine if the test set is operating properly.

2-17. SHIPPING INSTRUCTIONS

2-18. USING ORIGINAL PACKAGING

2-19. The same container and packing material used in factory packaging can be obtained through Hewlett-Packard Sales and Service Offices listed at the back of this manual. If the test set is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service or repair required, return address, model number, option numbers, and full serial number. Also mark the container FRAGILE to assure careful handling. In any correspondence, refer to the test set by model number, option numbers, and full serial number.

2-20. USING OTHER PACKAGING

2-21. The following general instructions should be used for repackaging with commercially available materials:

a. Wrap the test set in heavy paper or plastic. If shipping to a Hewlett-Packard Sales and Service Office, attach a tag indicating the type of service required, return address, model number, option numbers, and full serial number.

b. Use a strong shipping container. A double-wall carton made of 275 pound test material is adequate.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the test set to provide firm cushioning and prevent movement inside the container.

d. Seal the shipping container securely and mark it FRAGILE to assure careful handling.

e. In any correspondence, refer to the test set by model number, option numbers, and full serial number.

2-22. HP-IB ADDRESS SELECTION

2-23. The HP-IB address selector switch is located on the HP-IB PC board assembly A21. The switch is preset at the factory for:

	ASCII	Binary
Talk Address	J	1001010
Listen Address	*	0101010

MSB LSB

The last five bits in the binary code are switch selectable. The first two digits (most significant) are "hard wired" into the HP-IB circuitry.

2-24. To change the address of the 4943A, follow this procedure:

a. Turn off the power switch and unplug the power cord.

b. Release the top cover by turning the four top screws 1/4 turn counterclockwise.

c. Remove the top cover.

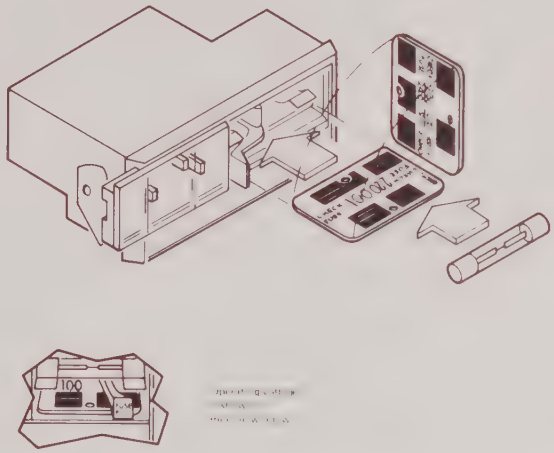
d. Partially pull out the A21 board (no need to pull it all the way out and disconnect cable).

e. The address selector switch is seven SPST switches contained in a dual-in-line (DIP) package. See Figure 2-2. The figure shows the switch with the factory preset values.

f. The switch settings may now be changed with a pointed instrument (like a pencil or pen).

NOTE

Do not set all address switches to the "1" position. This code is reserved for special use.



PROCEDURE

1. Slide cover door to left (the line power cord must be disconnected).
2. Rotate FUSE PULL to left. Remove the fuse.
3. Remove the PC board by pulling it out. Select operating voltage by positioning PC board to show the desired voltage on top-left side.
4. Reinsert the PC board.
5. Rotate FUSE-PULL back into normal position and reinsert fuse. Use caution to select correct fuse value.

Figure 2-1. Line Voltage Selection

MSB				LSB	ASCII LISTEN ADDRESS	ASCII TALK ADDRESS
0	0	0	0	0	SP	@
0	0	0	0	1	!	A
0	0	0	1	0	"	B
0	0	0	1	1	#	C
0	0	1	0	0	$	D
0	0	1	0	1	%	E
0	0	1	1	0	&	F
0	0	1	1	1	'	G
0	1	0	0	0	(	H
0	1	0	0	1	)	I
0	1	0	1	0	*	J
0	1	0	1	1	+	K
0	1	1	0	0	,	L
0	1	1	0	1	–	M
0	1	1	1	0	.	N
0	1	1	1	1	/	O
1	0	0	0	0	0	P
1	0	0	0	1	1	Q
1	0	0	1	0	2	R
1	0	0	1	1	3	S
1	0	1	0	0	4	T
1	0	1	0	1	5	U
1	0	1	1	0	6	V
1	0	1	1	1	7	W
1	1	0	0	0	8	X
1	1	0	0	1	9	Y
1	1	0	1	0	:	Z
1	1	0	1	1	;	[
1	1	1	0	0	<	\
1	1	1	0	1	=	]
1	1	1	1	0	>	^

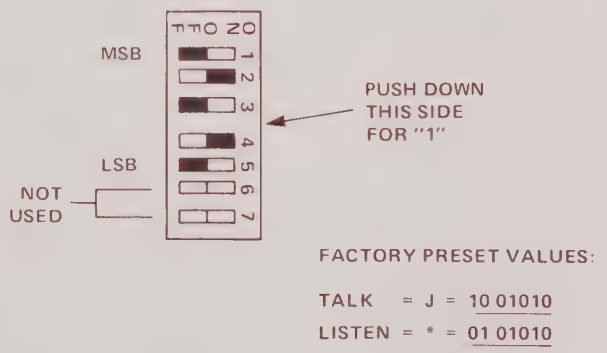


Figure 2-2. HP-IB Address Selection

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SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section contains information on front and rear panel features, self check procedures, condition codes (H-codes), and operation using the remote HP-IB interface. Also covered are the principles of operation for all measurements, plus master-slave operation.

3-3. If any of the self check procedures fail acceptable limits as specified in the checks, then adjustment or repair may be necessary.

3-4. Operating instructions for the Model 4943A are covered in this manual only to the extent needed for service. For specific operating procedures, see the 4943A Operating Instructions booklet, HP P/N 04943-90001.

3-5. SELF CHECK

3-6. The self check procedures should be performed periodically by the instrument user to verify performance. The self check procedures should be used for incoming inspection to verify a customer complaint and to determine if any other problems exist. The self check procedures should also be performed prior to the performance checks. The performance checks then verify that the instrument meets published specifications. Failure of the instrument to pass any self check procedure indicates a malfunction that can possibly affect other measurements.

3-7. CONDITION CODES

3-8. Under certain conditions, the 4943A will abort or fail to achieve its normal display. The display will then show a "condition code" or "error code". All these codes contain an "H" prefix followed by two numerals (such as H-08). The self check procedures in Figure 3-2 contain a list of the codes possible when self check fails. Table 3-1 lists the codes possible during normal operation.

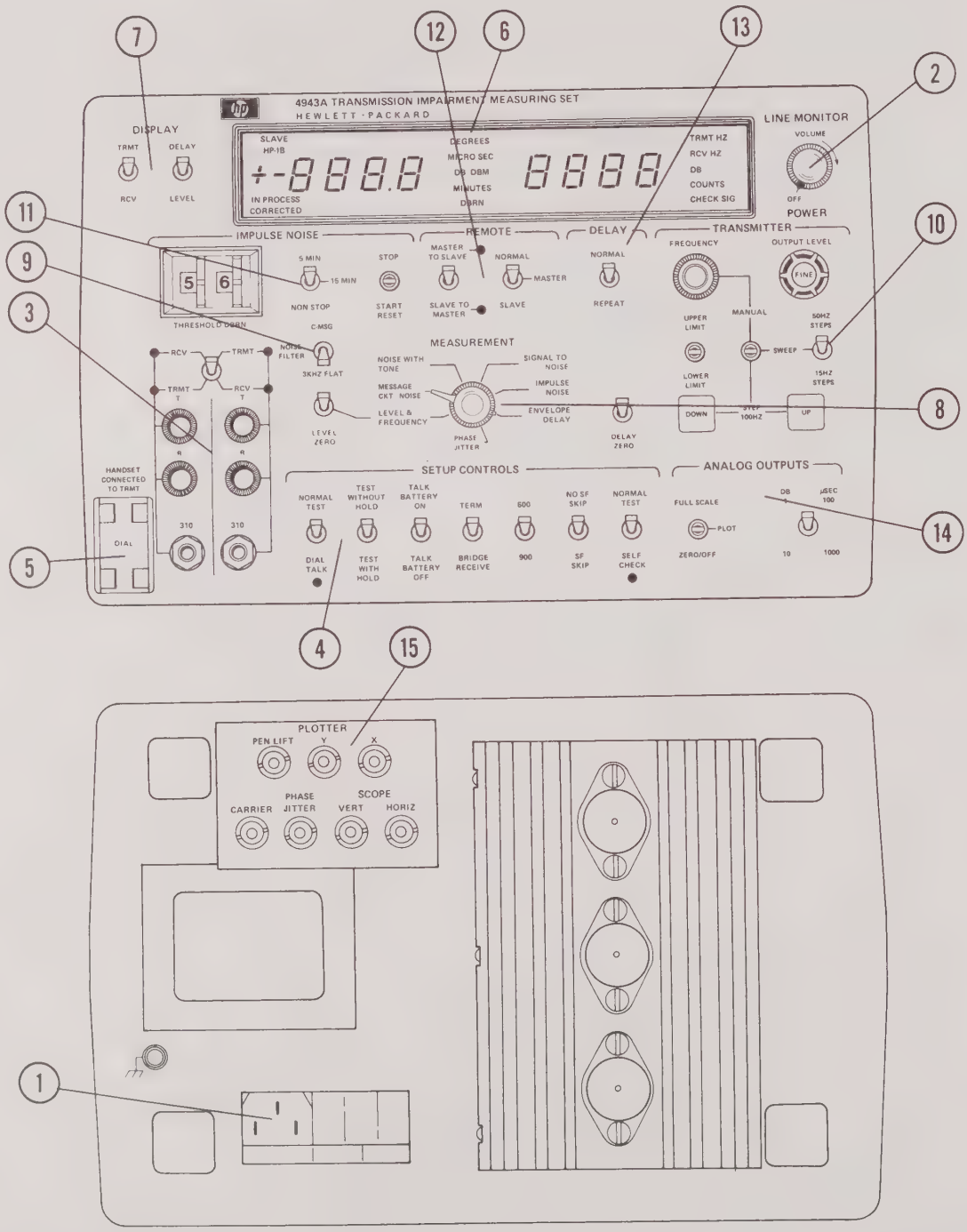


Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (1 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

(1) **Power Cord Module.** Accepts power cord supplied with instrument. Contains line fuse and PC board for selecting line voltage (see Section II of the 4943A Operating and Service Manual). WARNING: ALWAYS CONNECT POWER CORD TO A PROPERLY GROUNDED 3-WIRE POWER OUTLET.

(2) **LINE MONITOR Volume/POWER Off Control.** Switches instrument ac operating power ON and OFF and controls volume of LINE MONITOR speaker. The DISPLAY TRMT -- RCV switch determines whether the transmitted or received signal is being monitored. The speaker is located on the right-hand side panel.

(3) **RCV-TRMT Jacks.** A two position toggle switch is used to reverse connections of the left and right jack fields. When switch is in up position, the left jacks are connected for RCV (receive) and the right jacks for TRMT (transmit). When switch is down, connections are reversed. Dot lamps indicate functions of respective jack fields. Connections can be made either to the 310 jacks, or to the TIP and RING binding posts, which are multipled.

(4) **SETUP CONTROLS.**

NORMAL TEST – DIAL/TALK Switch. In NORMAL TEST position the selected TRMT jack is connected to the test set's transmitter circuitry, but not to the DIAL connectors. In DIAL/TALK position the TRMT jack is connected to the DIAL connectors, but not to the transmitter circuitry.

TEST WITHOUT HOLD – TEST WITH HOLD Switch. In TEST WITHOUT HOLD position the test set holding circuits are disconnected from the RCV-TRMT jacks. In TEST WITH HOLD position the holding circuits are connected across TIP and RING of both jack fields to hold 2-wire wet (DDD) circuits while testing.

TALK BATTERY ON – TALK BATTERY OFF Switch. In TALK BATTERY ON position the test set provides the necessary talk battery to the DIAL terminals to talk on dry circuits with a lineman's handset. In TALK BATTERY OFF position, talk battery must be supplied by the circuit under test if talking is desired.

TERM – BRIDGE RECEIVE Switch. In TERM position the test set provides a termination on both the RCV AND TRMT circuits. The desired terminating impedance must be selected with the 600-900 switch. In BRIDGE-RECEIVE position the receiving test set is bridged across the circuit under test, which must be terminated with other equipment. NOTE: When using BRIDGE RECEIVE it is still necessary to select the proper impedance of the line under test with the 600-900 switch in order to normalize the measurements.

600-900 Switch. The 600 Ω or 900Ω termination must be selected to match the characteristic impedance of the line under test. When operating in TERM mode, both the TRMT and RCV circuits are terminated in the selected impedance. When operating in BRIDGE RECEIVE mode, the TRMT circuit is still terminated in the selected impedance and the RCV circuit is bridged by more than 45 kΩ. The selection also normalizes level measurements for the respective impedances.

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (2 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

NO SF SKIP – SF SKIP Switch. In NO SF SKIP position the test set will transmit all selected frequencies. In SF SKIP position the test set will not transmit any frequencies between 2450 Hz and 2750 Hz. This feature prevents the circuit under test from being disconnected by SF signaling units on the dial-up network.

NORMAL TEST – SELF CHECK Switch. In NORMAL TEST position the test set performs normal testing. In SELF CHECK position proper operation of the test set can be verified by performing the procedures given in the SELF CHECK section of this manual.

(5) **DIAL Connectors.** Provides connections for a lineman's handset (butt-in). The terminals are connected to the selected TRMT jack when the DIAL/TALK mode is selected.

(6) **Digital Displays.** Two digital displays provide quantitative information and measurement units for all measurements. Ranging is automatic, and polarity and decimal points are automatically displayed when appropriate. Up to two parameters can be displayed simultaneously. The displays also indicate underrange and overrange conditions. Display of only a (–) sign indicates underrange. Display of only a (+) sign indicates overrange.

(7) **DISPLAY Switches.**

TRMT – RCV Switch. Selects either the transmitted or received information to be displayed.

LEVEL – DELAY Switch. Used in ENVELOPE DELAY measurements to display either level (DBM) or delay (MICRO SEC) information.

(8) **MEASUREMENT Switch.** Programs the test set to perform the selected measurement. For a detailed procedure describing the use of each MEASUREMENT switch position, see the appropriate section of this manual.

LEVEL ZERO Switch. Used in LEVEL & FREQUENCY mode to establish a zero dB reference. All subsequent measurements will be made in dB relative to this reference. If this switch is not operated, measurements will be in absolute dBm. NOTE: If LEVEL ZERO switch has been actuated and it is desired to make an absolute dBm measurement, momentarily rotate MEASUREMENT switch to another position, then back to LEVEL & FREQUENCY again.

DELAY ZERO Switch. Used in ENVELOPE DELAY mode to establish a zero microsecond delay reference. All subsequent envelope delay measurements will be relative to this reference.

(9) **NOISE FILTER Switch.** Used in NOISE measurements to select desired weighting filter (C-MSG or 3KHZ FLAT).

(10) **TRANSMITTER Controls.**

MANUAL – SWEEP – STEP 100 HZ Switch. In MANUAL position frequency is continuously variable from 200 Hz to 3950 Hz by adjusting FREQUENCY control. In SWEEP position frequency automatically steps up and down in 50 Hz or 15 Hz steps selected by 50 HZ STEPS – 15 HZ STEPS switch. Upper and lower sweep limits are set by tuning to desired frequency in MANUAL or STEP 100 HZ and momentarily activating UPPER LIMIT – LOWER LIMIT switch.

OUTPUT LEVEL Control. Varies transmitter output level continuously from –39 dBm to +10 dBm. Output level is displayed on left display.

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (3 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

(11) **IMPULSE NOISE Controls.**

THRESHOLD DBRN Switches. Sets the desired threshold above which impulse noise peaks will be totalized on the display. The threshold is adjustable from 30 to 109 dBrn.

5 MIN – 15 MIN – NONSTOP Count Time Switch. Selects length of time for which impulse noise is counted. Counting is stopped automatically when either the 5 MIN or 15 MIN positions are selected. Counting must be stopped manually with the STOP – START/RESET switch when the NONSTOP position is selected.

STOP – START/RESET Switch. Impulse noise counting is stopped and total is held on display when switch is momentarily held in STOP position. All previous counts are reset to zero on display and new counting interval is initiated when switch is momentarily held in START/RESET position.

(12) **REMOTE Switches.**

MASTER TO SLAVE – SLAVE TO MASTER Switch. Selects transmission path to be tested. Selecting the MASTER TO SLAVE position will cause the circuit connected to the TRMT jack at the MASTER unit to be tested. Selecting the SLAVE TO MASTER position will cause the circuit connected to the RCV jack at the MASTER unit to be tested. The dot lamp associated with the respective position indicates that the MASTER unit has achieved control of the SLAVE unit. The lamp should light within 10 seconds after the NORMAL – MASTER – SLAVE switches are properly positioned on both the MASTER and SLAVE units.

NORMAL – MASTER – SLAVE Switch. In NORMAL position all controls are under manual front panel control. The test set can be operated manually with other compatible test sets. In MASTER position the unit is in remote control of the SLAVE unit for all MEASUREMENT functions. In SLAVE position the unit is remotely controlled by the MASTER unit for all MEASUREMENT functions.

(13) **DELAY Switch.** Used in ENVELOPE DELAY mode to determine whether the test set is to measure envelope delay (NORM), or to retransmit the envelope delay signal from the far-end of the circuit (REPEAT). This control is not used during MASTER-SLAVE operation.

(14) **ANALOG OUTPUTS Controls.**

FULL SCALE – PLOT – ZERO/OFF Switch. In FULL SCALE position, full scale voltage (+10V) is applied to X and Y output jacks for use in calibrating upper right corner of X-Y Recorder plot. In PLOT position, voltages proportional to frequency or time and measured signal are sent to X and Y output jacks respectively. In ZERO/OFF position 0 volts is applied to both X and Y outputs for use in calibrating lower left corner of X-Y Recorder plot or for deactivating analog output signals.

DB USEC Switch. Selects sensitivity for Y Axis scale. In upper position each internally generated graticule line represents 1 dB in LEVEL & FREQUENCY and 100 uS in ENVELOPE DELAY. In lower position, each graticule line represents 10 dB and 1000 uS respectively.

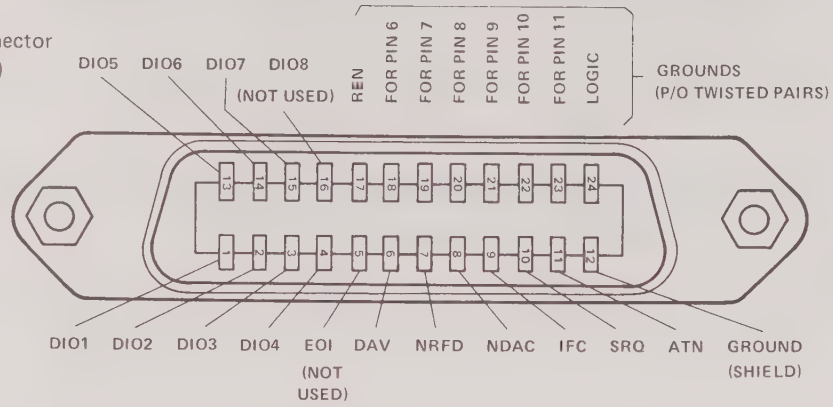
(15) **ANALOG OUTPUT Connectors.** Used to connect analog output circuitry to an oscilloscope or strip chart recorder. Refer to 4943A Operating and Service Manual for complete description and connection instructions.

(15) **Option 010 only:** Due to rear panel space restrictions, the BNC connectors are replaced by a 14-pin connector for Analog Outputs, in addition to the added 24-pin connector for Hewlett-Packard Interface Bus (HP-IB).

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (4 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

(15) HP-IB Connector (Continued)



LOGIC LEVELS

HP-IB logic levels are low true and TTL compatible (LO = 0.0 to +0.4 Vdc, HI = +2.5 to +5.0 Vdc).

Example: SRQ is LO active.
NRFD is HI active.

Input Signals:

Each input line is terminated with 3000 ohms to +5V and 6200 ohms to ground (one TTL load).

Output Signals:

Each output can drive 15 HP-IB loads. The output is an open-collector driver capable of sinking 48 mA at 0.4V output.

SIGNALS

NRFD

Ready For Data. Indicates 4943A will accept data when NRFD is HIGH.

NDAC

Data Accepted. Indicates 4943A has accepted data. Returns to LOW when 4943A is finished processing data.

DAV

Data Valid. Indicates valid output data is available from 4943A if addressed to talk. Input data is available if 4943A is addressed to listen and ATN is HIGH. Address is valid if ATN is LOW.

ATN

Attention. A LOW state indicates commands are present on the DIO lines. A HIGH state indicates data is present on the DIO lines.

DIO1 thru DIO8

Data Input-Output lines. Message bytes are carried on the DIO signal lines in a bit-parallel byte-serial form, asynchronously and generally in a bidirectional manner. DIO8 not used in 4943A.

REN

Remote Enable. Used by the controller to cause the 4943A to be placed in the remote mode.

SRQ

Service Request. Indicates the 4943A wants the attention of the controller.

IFC

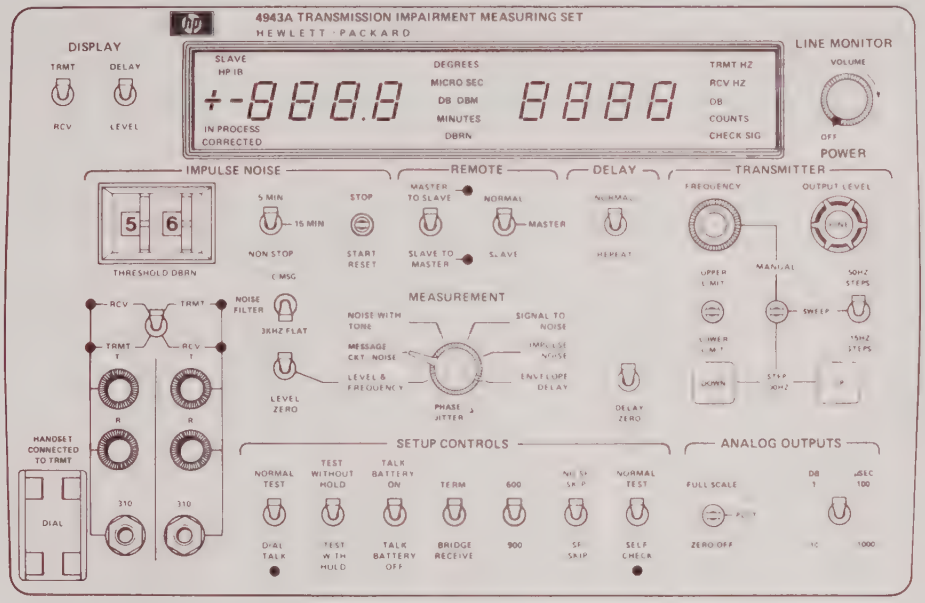
Interface Clear. Used by the controller to terminate all activity on the bus.

EOI

Not used in 4943A.

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (5 of 5)

SELF CHECK PROCEDURES



NOTE

The SELF CHECK routine automatically makes an operational check of the test set, including its ability to operate in MASTER and SLAVE modes. The test set will automatically step through the SELF CHECK routine and should produce indications at each step as indicated below. At the end of the SELF CHECK routine, the display will indicate PASS if all checks are within specifications. If any steps fail to pass, the display will indicate failure codes at the end of the routine for those steps that fail to pass. A list of SELF CHECK failure codes, and their meanings are given at the end of this procedure.

The SELF CHECK procedure should be performed periodically to verify performance of the test set. SELF CHECK is recommended before transporting the test set to a remote testing site; or whenever there is any doubt about transmission measurement results.

1. PRELIMINARY SETUP

   a. Disconnect test set from on-line testing.

   b. Switch POWER ON.

   c. Loop TRMT jack to RCV jack. Operate RCV/TRMT jack field switch and observe that corresponding dot lamps light.

   d. Set all SETUP CONTROLS Switches to "up" positions.

   e. Set NORMAL TEST – SELF CHECK Switch to SELF CHECK.

Figure 3-2. Self Check Procedures (1 of 3)

SELF CHECK PROCEDURES

2. STEP 1: DISPLAY AND ANNUNCIATOR CHECKS

   a. Observe that left display indicates +888.8 and that right display indicates 8888. Observe that all numerical segments are present and evenly illuminated.

   b. Observe that all display annunciators (except the minus sign) are on and evenly illuminated.

   c. Observe that MASTER TO SLAVE and SLAVE TO MASTER dot lights are on.

NOTE

It is not necessary to observe the following test routine unless it is desired to analyze a specific problem with the test set. SELF CHECK status will be displayed at the end of the routine.

3. STEPS 2-4: LEVEL & FREQUENCY CHECKS

   a. Left display should indicate +0.0 DBM (±0.3 dBm). Right display should indicate 1004 RCV HZ (±2 Hz).

   b. Left display should indicate +0.0 DB (±0.3 dB). Right display should indicate 204 RCV HZ (±2 Hz).

   c. Left display should indicate +0.0 DB (±0.3 dB). Right display should indicate 3904 RCV HZ (±2 Hz).

4. STEPS 5-7: C-MESSAGE FILTER CHECKS

   a. Left display should indicate +0.0 DB (±0.3 dB). Right display should indicate 1004 RCV HZ (±2 Hz).

   b. Left display should indicate +16.0 DB (±1.0 dB). Right display should indicate 304 RCV HZ (±2 Hz).

   c. Left display should indicate +2.5 DB (±1.0 dB). Right display should indicate 3004 RCV HZ (±2 Hz).

5. STEPS 8-10: 3 KHZ FLAT FILTER CHECKS

   a. Left display should indicate +0.0 DB (±0.3 dB). Right display should indicate 1004 RCV HZ (±2 Hz).

   b. Left display should indicate +0.0 DB (±0.5 dB). Right display should indicate 304 RCV HZ (±2 Hz).

   c. Left display should indicate +3.0 DB (±2.0 dB). Right display should indicate 3004 RCV HZ (±2 Hz).

6. STEP 11: NOISE-WITH-TONE NOTCH CHECK

   a. Left display should indicate greater than +50 DBM. Right display should indicate 1004 RCV HZ (±2 Hz).

7. STEP 12: IMPULSE NOISE CHECK

   a. Right display should indicate 70 COUNTS (±4 Counts).

8. STEP 13: ENVELOPE DELAY CHECK

   a. Left display should reset to 0 MICROSECONDS, then indicate 3000 MICROSECONDS (±10μS). Right display should indicate 1804 RCV HZ (±2 Hz).

9. STEPS 14-15: PHASE JITTER CHECKS

   a. Left display should read +0.0 DEGREES (±0.2 Deg.). Right display should indicate 1004 RCV HZ (±2 Hz).

   b. Left display should read +11.5 DEGREES (±0.7 Deg.). Right display should indicate 1004 RCV HZ (±2 Hz).

10. STEP 16: SELF CHECK STATUS DISPLAY

    a. If all SELF CHECK tests are within specifications, the display will indicate PASS until the NORMAL TEST-SELF CHECK switch is returned to the NORMAL TEST position. The test set has passed, in addition to the above visible tests, an ENVELOPE DELAY response time test, an IMPULSE NOISE time base generator test, and a complete check of the modem used for MASTER-SLAVE operation.

    b. If the instrument fails to pass any of the above tests, failure codes will be displayed indicating the tests that have failed. These codes will be displayed sequentially until the NORMAL TEST-SELF CHECK switch is returned to the NORMAL TEST position. The table at right shows interpretations of the SELF CHECK failure codes that can be displayed.

Figure 3-2. Self Check Procedures (2 of 3)

SELF CHECK PROCEDURES

11. SELF CHECK – MODEM ONLY.

If a quick SELF CHECK of only the modem is desired, the following procedure can be used:

a. Perform PRELIMINARY SETUP procedures (a) through (d).

b. Switch to SELF CHECK. Depress and hold DELAY ZERO Switch until left display indicates "PASS", then release.

c. If modem passes SELF CHECK, display will immediately indicate PASS. Refer to failure codes, at right, if failure code is displayed.

SELF CHECK FAILURE CODES

CODE	MESSAGE
H16	Test signal not looped around.
H20	Level out of tolerance at 204 Hz (STEP 3).
H21	Level out of tolerance at 1004 Hz (STEP 2).
H22	Level out of tolerance at 3904 Hz (STEP 4).
H30	C-Message Filter out of tolerance at 304 Hz (STEP 6).
H31	C-Message Filter out of tolerance at 1004 Hz (STEP 5).
H32	C-Message Filter out of tolerance at 3004 Hz (STEP 7).
H33	Noise-With-Tone notch filter out of tolerance (STEP 11).
H34	Impulse Noise counts out of tolerance (STEP 12).
H35	3KHZ FLAT Filter out of tolerance at 304 Hz (STEP 9).
H36	3KHZ FLAT Filter out of tolerance at 1004 Hz (STEP 8).
H37	3KHZ FLAT Filter out of tolerance at 3004 Hz (STEP 10).
H38	Impulse Noise time base generator out of tolerance (STEP 12).
H40	Frequency out of tolerance at 1004 Hz (STEP 2).
H41	Frequency out of tolerance at 204 Hz (STEP 3).
H42	Frequency out of tolerance at 3904 Hz (STEP 4).
H50	Residual Phase Jitter out of tolerance (STEP 14).
H51	Phase Jitter out of tolerance (STEP 15).
H70	Envelope Delay response time out of tolerance (STEP 13).
H71	Envelope Delay accuracy out of tolerance (STEP 13).
H72	Envelope Delay 83-1/3 modulation missing (STEP 13).
H80 H81 H82 H83 H84	Test set modem does not pass SELF CHECK (NOTE: Failure of the modem affects only MASTER – SLAVE operation. Normal operation is not affected.)

Figure 3-2. Self Check Procedures (3 of 3)

Table 3-1. Condition Codes (1 of 2)

Under certain conditions, the 4943A will abort or fail to achieve its normal display and indicate a "condition code" in the display. Following is a list of condition codes that can occur, their messages, probable causes, and recommended remedial actions to clear the condition. (Also refer to SELF CHECK procedure for listing of SELF CHECK failure codes).

CONDITION CODE	MESSAGE	PROBABLE CAUSES	RECOMMENDED ACTIONS
H-00	Front panel controls changed while MASTER attempting to achieve control over SLAVE.	1. Operator error.	1. Do not touch controls until dot light illuminates.
H-01	No data carrier received from SLAVE.	1. SLAVE OUTPUT LEVEL set too low	1. Check SLAVE OUTPUT LEVEL.
		2. Excessive circuit loss.	2. Check that MASTER receives at least –40 dBm.
		3. 4943A problem.	3. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
H-02, H-11	No data information received from SLAVE.	1. Excessive noise on circuit.	1. Check circuit noise and impulse noise.
		2. 4943A problem.	2. Perform SELF CHECK on SLAVE unit. Return test set for repair if necessary.
H-03, H-04	Data errors.	1. Excessive noise on circuit.	1. Check circuit noise and impulse noise.
		2. 4943A problem.	2. Perform SELF CHECK on MASTER unit. Return test set for repair if necessary.
H-05	Inappropriate response to MASTER-SLAVE commands.	1. 4943A problem.	1. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
		2. Distortion on circuit due to high level or circuit malfunction.	2. Check MASTER and SLAVE OUTPUT LEVELS.
H-06	SLAVE not responding to MASTER command.	1. MASTER OUTPUT LEVEL set too low.	1. Check MASTER OUTPUT LEVEL.
		2. Excessive circuit loss.	2. Check that SLAVE receives at least –40 dBm.
		3. Excessive noise on circuit.	3. Check circuit noise and impulse noise.
		4. 4943A problem.	4. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.

Table 3-1. Condition Codes (2 of 2)

CONDITION CODE	MESSAGE	PROBABLE CAUSES	RECOMMENDED ACTIONS
H-07	Incompatible SLAVE measurement.	1. SLAVE is being requested to make a measurement it is not capable of making.	1. SLAVE must be compatible with MASTER (or it aborts to LINE LOOP BACK mode for measurements not available in SLAVE unit).
H-08	Invalid command.	1. 4943A problem.	1. Perform SELF CHECK on MASTER unit. Return test set for repair if necessary.
H-09	No data received when expected.	1. Circuit dropout. 2. SLAVE OUTPUT CONTROL moved during data transmission. 3. 4943A problem.	1. Check circuit; re-run test. 2. Do not touch SLAVE OUTPUT Control while measurement in progress. 3. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
H-10	SLAVE Underrange; test Level or Noise below range capability.	1. Receive LEVEL less than −70 dBm. 2. Receive NOISE less than +20 dBrn.	1. Normal condition; no action necessary.
H-11 See H-02			
H-12	IMPULSE NOISE	1. IMPULSE NOISE exceeded 9999 COUNTS.	1. User shorter counting interval.
H-13	MASTER lost control of SLAVE.	1. SLAVE REMOTE Switch changed to NORMAL or MASTER during data transmission.	1. Do not touch SLAVE REMOTE Switch while measurement in progress.
H-14	Signal dropout >1 Sec. during IMPULSE NOISE measurement.	1. Circuit dropped out carrier.	1. Initiate new test.
H-15	PHASE JITTER overrange.	1. PHASE JITTER greater than 40 DEGREES.	1. Normal condition; no action necessary.
H-16	Improper test signal.	1. Operator error.	1. Check for proper MEASUREMENT Switch position at sending test set.

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3-9. OPERATION USING HP-IB (Option 010)

3-10. The HP-IB option adds remote programming and data output capability to the 4943A. The HP-IB interface is Hewlett-Packard's implementation of the IEEE Standard 488-1975.

3-11. RELATED DOCUMENTATION

3-12. A separate publication is available which details the use of the 9825A controller with the 4943A. This operating note, HP P/N 04943-90026, is titled "Operating Your HP Model 4943A Transmission Impairment Measuring Set with the HP Model 9825A Controller". Included in the note is a sample master-slave program, plus an optional HP-IB verification program. If the user is contemplating the use of a 9825A with the 4943A, then this note would be helpful.

3-13. PROGRAMMING DATA

3-14. Table 3-2 through 3-6 provide the user with the needed reference data for remotely operating the Model 4943A. Table 3-2 lists the program code set, giving the codes necessary to implement the programmable measurement functions. Table 3-3 gives the status byte format as output by the 4943A. Table 3-4 lists the allowable HP-IB bus messages. Table 3-5 is a list of the recommended timing delays needed after various actions are implemented. Finally, the format of the 4943A output data character string is given in Table 3-6. This table shows the content of the data word as the 4943A sends it to the controller. This format differs from measurement to measurement.

3-15. PROGRAMMABILITY

3-16. Most front panel controls are remotely programmable via HP-IB. The exceptions are:

a. POWER switch.

b. SETUP CONTROLS

c. TRANSMITTER OUTPUT LEVEL.

d. IMPULSE NOISE THRESHOLD thumbwheel switches.

e. LINE MONITOR VOLUME

f. ANALOG OUTPUTS.

g. RCV-TRMT switch.

These controls must be set manually by the operator before proceeding with the use of remote HP-IB operation.

3-17. TIMING CONSIDERATIONS

3-18. The Model 4943A does not respond instantly to measurement commands. Nor does the telephone circuit under test settle immediately. Timing considerations therefore play an important role when writing software. Table 3-5 lists the timing delays necessary for the 4943A. Timing delays necessary for the circuit under test will need to be determined by observation or experiment.

3-19. PARTIAL CHANGE OF MEASUREMENT PARAMETERS

3-20. When a partial change of measurement parameters is needed, only the changed parameter need be attended to. In effect, the 4943A "remembers" all previous instructions except the changed portion of the instruction. For instance, once a measurement is set up (like Level & Frequency), the transmitter frequency may be changed independently. The other parameters, such as setting the measurement or display, are left unchanged.

3-21. DETECTING INVALID MEASUREMENT DATA

3-22. After entering any measurement data, the data should be checked for validity before use. Four checks can be made of the data. First, determine if an H-code has been entered. Secondly, determine if an underrange condition exists. Thirdly, determine if an overrange exists. Finally, check if a frequency error has occurred. For instance, if a measurement instruction specifies an 804 Hz transmit frequency by a slave unit, did the master receive it?

3-23. An H-code appears as the numbers 9900 to 9916 in the left display data. An underrange is indicated by –9999 in the left display data; an overrange by 9999.

Table 3-2. HP-IB Program Code Set (1 of 2)

CHARACTER (ASCII CODE)	FUNCTION	OCTAL CODE	DECIMAL CODE
R	Remote (Master-Slave) Identifier	122	82
0	Normal	060	48
1	Master & Master-to-Slave	061	49
2	Master & Slave-to-Master	062	50
3	Slave	063	51
M	Measurement Identifier	115	77
1	Level & Frequency	061	49
2	Message Circuit Noise	062	50
3	Noise-with-Tone	063	51
4	Signal + Noise to Noise Ratio	064	52
5	Impulse Noise	065	53
6	Envelope Delay (Display ED & Frequency)	066	54
7	Phase Jitter or Nonlinear Distortion	067	55
W	Noise Filter Identifier	127	87
0	C-Message Filter	060	48
1	3 KHz Flat Filter	061	49
N	NLD Control Identifier	116	78
0	Normal Test	060	48
1	Check Signal	061	49
D	Display Identifier	104	68
0	Display Transmitter	060	48
1	Display Receiver	061	49
2	Display Delay (use with M6)	062	50
3	Display Level (use with M6)	063	51
F	Frequency Identifier	106	70
(x)xxx	Any Frequency between 204 Hz and 3904 Hz	—	—
Z	Zero Identifier	132	90
0	Level Zero	060	48
1	Delay Zero	061	49
P	Impulse Noise Period Identifier	120	80
0	5 Minutes	060	48
1	15 Minutes	061	49
2	Non-Stop	062	50
I	Impulse Noise Identifier	111	73
0	Stop	060	48
1	Start/Reset	061	49
L	Delay Identifier	114	76
0	Envelope Delay Normal Set	060	48
1	Envelope Delay Repeat Set	061	49
O	Output Identifier	117	79
0	Output measurement data when addressed	060	48
1	Pull Service Request to output data	061	49

Table 3-2. HP-IB Program Code Set (2 of 2)

CHARACTER (ASCII CODE)	FUNCTION	OCTAL CODE	DECIMAL CODE
S	Sweep Identifier	123	83
0	Set Upper Limit	060	48
1	Set Lower Limit	061	49
2	Stop Sweep	062	50
3	Start Sweep	063	51
4	50 Hz Step	064	52
5	15 Hz Step	065	53
C	Self Check Identifier	103	67
0	Stop	060	48
1	Start	061	49
E	Execute Identifier Note: "E" must be last character in each program code set. Example: cmd 7, "?U*", "M1E"	105	69
Factory Preset Address: Talk = J, Listen = *			

Table 3-3. Status Byte

(LSB)

BIT	7	6	5	4	3	2	1	Ø
	Ø	SERVICE REQUEST	Ø	DATA READY	Ø	Ø	Ø	Ø

- Bits Ø thru 3, 5, and 7 are always logical zero.
- Bits 4 and 6 are logical 1 when the 4943A or 4944A is ready to output data, or when the 4943A or 4944A pulls service request.

Table 3-4. Allowable HP-IB Bus Messages

OPERATION	DESCRIPTION	9825A EXAMPLE
Data	Initiate a measurement. Read measurement data from instrument.	28: wrt 710,"R1M1E" 30: red 710,A,B
Clear (DCL)	Returns 4943A or 4944A to following setup: Normal Level & Frequency 1004 Hz Display Level Master-to-Slave No Self Check Non-Stop C-Message-Filter NLD Normal Test	34: clr 7
Remote	Enables remote operation of devices on bus. Enables remote operation of only 4943A or 4944A on bus.	37: rem 7 40: rem 710
Local (GTL)	Returns the 4943A or 4944A to local control when addressed.	43: lcl 710
Clear Lockout/ Set Local	Sets local mode on all bus devices.	47: lcl 7 or Press RESET key
Abort (IFC)	Clears all bus operations. Unaddresses all talkers and listeners.	50: cli 7 or Press RESET key
Checking Status Byte for Service Request (SRQ)	Determine if service has been requested by any device. Variable S will contain the byte. Bit 7 contains the status bit.	53: rds(7)→S 54: if bit(7,S)=1;ret
Serial Polling of 4943A or 4944A	Enter status byte from 4943A or 4944A and check for presence of service request. Variable Q will contain the decimal equivalent of the byte. The decimal equivalent is "80" for 4943A and 4944A when service requested.	58: rds(710)→Q 59: if Q=80;sto +10

Table 3-5. Timing Considerations

ACTION	RECOMMENDED MAXIMUM DELAYS *Note 1*	9825A EXAMPLE

Address TIMS to "listen" to remote enable	1/2 second	`65: rem 7`
		`66: wrt 710`
		`67: wait 500`
		or
		`70: rem 710`
		`71: wait 500`

Set measurement, normal mode.	2 seconds, except NLD, use 20 seconds	`74: wrt 710,"R0M1D1F100400E"` `75: wait 2000`
Set measurement, master-slave mode, master-to-slave	10 seconds, except NLD, use 40 seconds	`78: wrt 710,"R1M1D1F100400E"` `79: wait 10000`
Set measurement, master-slave mode, slave-to-master	10 seconds, except NLD, use 40 seconds	`82: wrt 710,"R2M1D1F100400E"` `83: wait 10000`
Level zero, normal mode	1/4 second	`86: wrt 710,"Z0E"` `87: wait 250`
Level zero, master-slave mode	2 seconds	`90: wrt 710,"Z0E"` `91: wait 2000`
Delay zero, normal mode	1/2 second	`94: wrt 710,"Z1E"` `95: wait 500`
Delay zero, master-slave mode	1/2 second	`99: wrt 710,"Z1E"` `100: wait 500`
NLD check signal, normal mode	20 seconds	`101: wrt 710,"N1E"` `102: wait 20000`

Change transmit frequency	2 seconds	`103: fmt 1,"F",f10.0,"E"`
		`104: for N=204 to 3804 by 200`
		`105: wrt 710.1,N`
		`106: wait 2000`
		`107: next N`

Start self check	100 seconds for standard 4943A
	
	120 seconds for 4943A – opt 012 or 4944A
		`110: wrt 710,"C1E"`
		`111: wait 30000`
		`112: wait 30000`
		`113: wait 30000`
		`114: wait 10000`
		`115: red 710,A`

Issue bus commands Local, Clear, and Abort	2 seconds	`119: cli 7` `120: wait 2000`

NOTE: 1. The delay values recommended are usually needed to allow TIMS to settle, and to prevent erroneous data entry. The delays presented are therefore typical maximum values. The user is encouraged to try shorter delay times when system efficiency is needed.

Table 3-6. HP-IB Output Data Format (1 of 2)

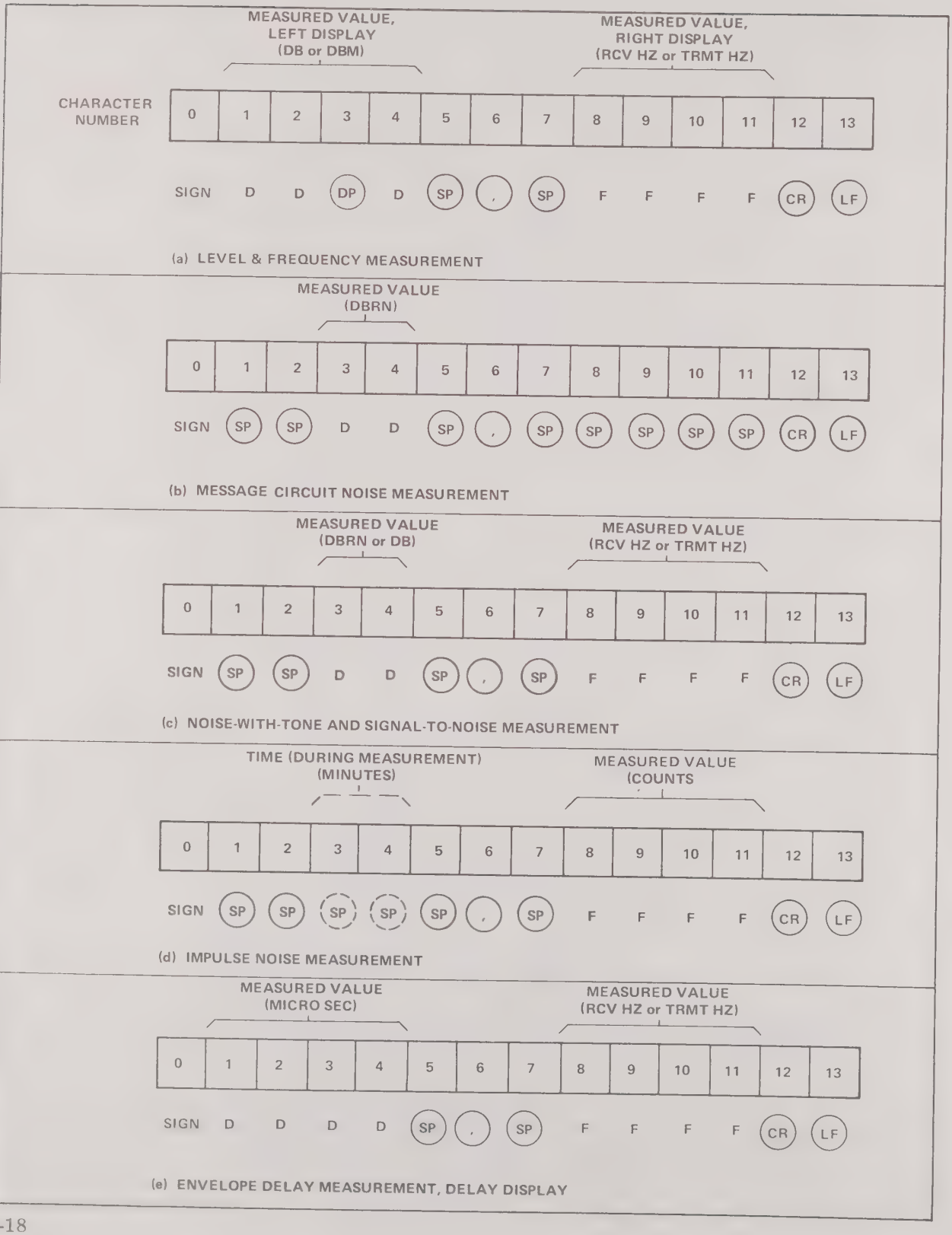
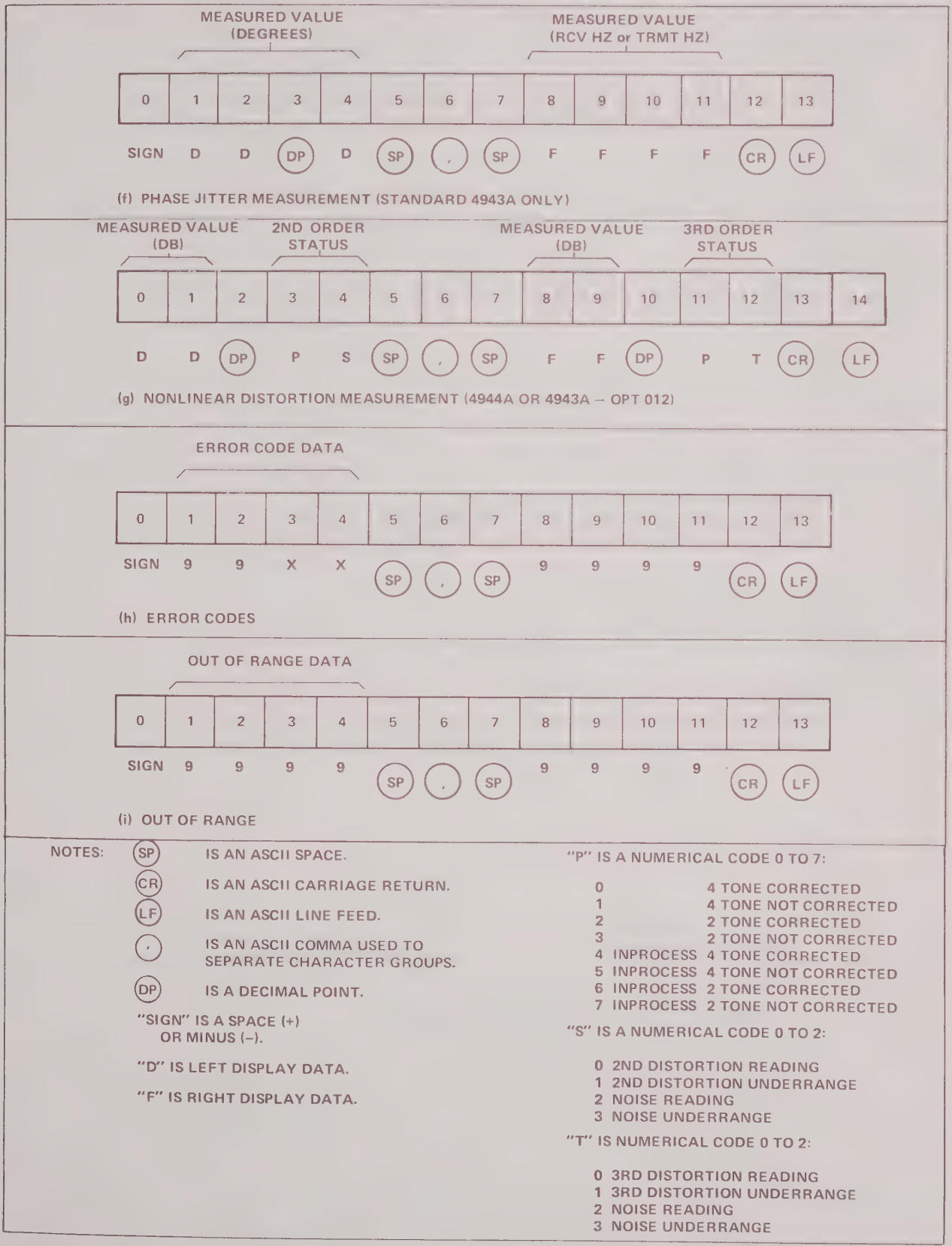


Table 3-6. HP-IB Output Data Format (2 of 2)



NOTES:

(SP) IS AN ASCII SPACE.

(CR) IS AN ASCII CARRIAGE RETURN.

(LF) IS AN ASCII LINE FEED.

(,) IS AN ASCII COMMA USED TO SEPARATE CHARACTER GROUPS.

(DP) IS A DECIMAL POINT.

"SIGN" IS A SPACE (+) OR MINUS (–).

"D" IS LEFT DISPLAY DATA.

"F" IS RIGHT DISPLAY DATA.

"P" IS A NUMERICAL CODE 0 TO 7:

0		4 TONE CORRECTED
1		4 TONE NOT CORRECTED
2		2 TONE CORRECTED
3		2 TONE NOT CORRECTED
4	INPROCESS	4 TONE CORRECTED
5	INPROCESS	4 TONE NOT CORRECTED
6	INPROCESS	2 TONE CORRECTED
7	INPROCESS	2 TONE NOT CORRECTED

"S" IS A NUMERICAL CODE 0 TO 2:

0	2ND DISTORTION READING
1	2ND DISTORTION UNDERRANGE
2	NOISE READING
3	NOISE UNDERRANGE

"T" IS NUMERICAL CODE 0 TO 2:

0	3RD DISTORTION READING
1	3RD DISTORTION UNDERRANGE
2	NOISE READING
3	NOISE UNDERRANGE

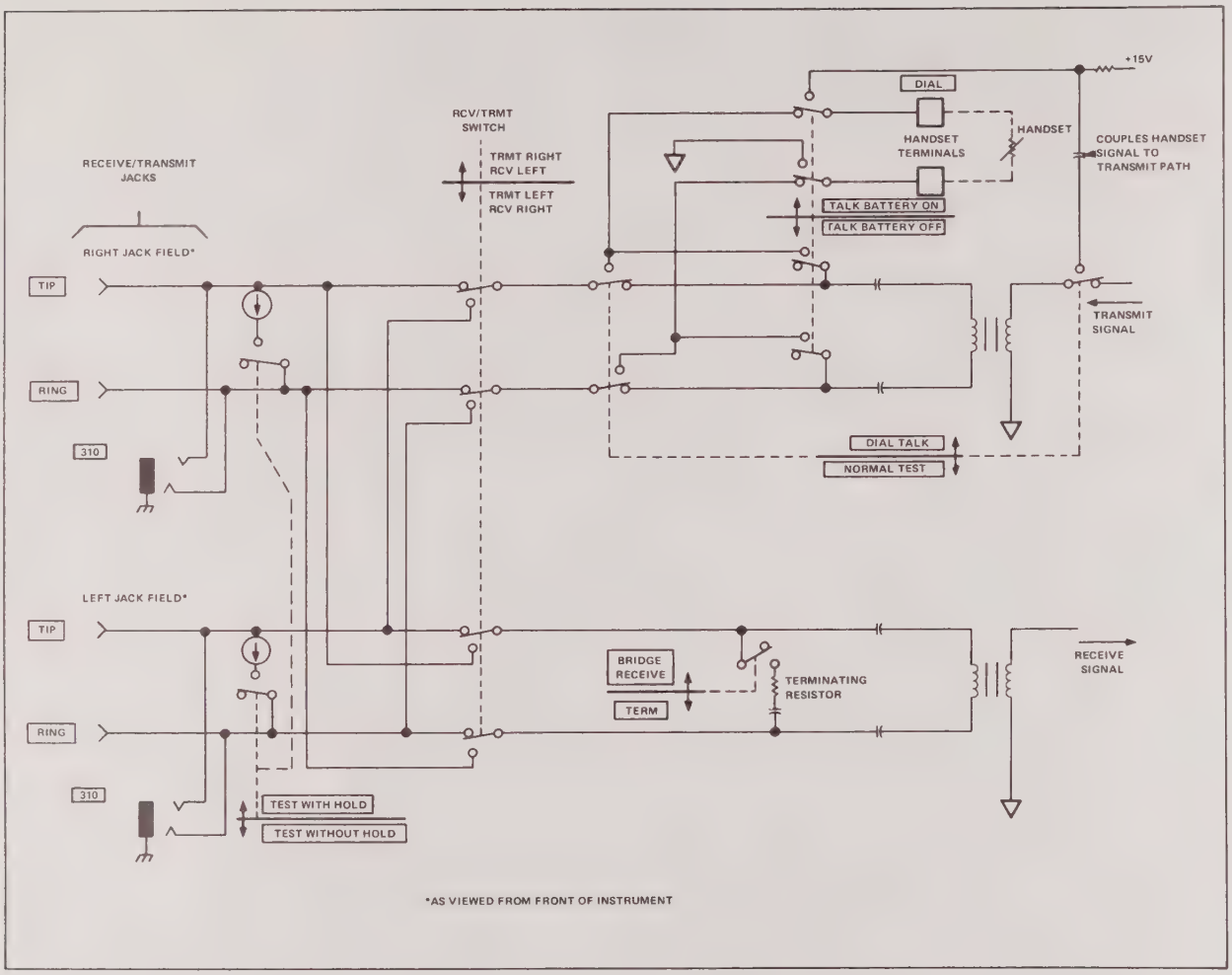


Figure 3-3. Input Switching

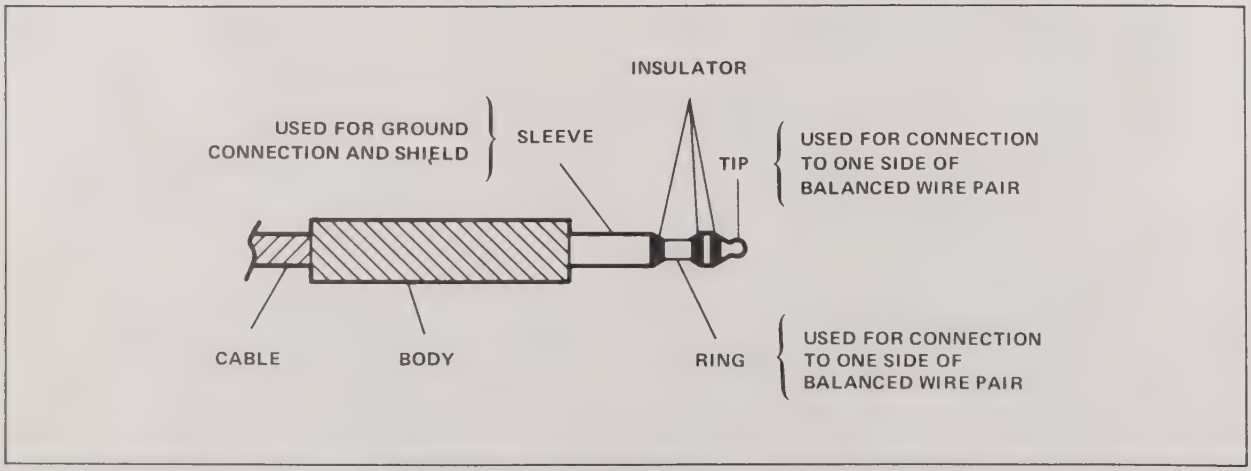


Figure 3-4. Western Electric 310 Plug

3-24. MEASUREMENT PRINCIPLES

3-25. The following text describes the principles of all measurements made by the Model 4943A. Block diagrams and functional descriptions are provided to explain input-output switching and the different measurements.

3-26. INPUT-OUTPUT SWITCHING

3-27. The receive/transmit jacks provide for interconnection of the 4943A to the telephone circuit under test. See Figure 3-3. The RCV/TRMT switch provides for selection of either the transmit or receive function for the left jack field, and simultaneously selects the opposite for the right jack field. Both the left and right jack felds provide parallel (multipled) connection jacks: standard five-way binding posts on top and Western Electric 310 type jacks on the bottom. Either the binding posts or the 310 jacks may be used; both of them should not be used at the same time. Figure 3-4 shows the construction of the 310 plug.

3-28. The TEST WITH HOLD/TEST WITHOUT HOLD setup switch allows the application of a 23 mA current source to the left and right jack field TIP and RING connectors. This provides for the latching of telephone switching equipment required in certain applications (functions as a holding coil).

3-29. The input and output impedance of the 4943A is selectable at either 600 or 900 ohms (not shown in Figure 3-3), which are standard telephone circuit values. The impedance of the 4943A must be selected to match the circuit under test, or erroneous measurement values will be obtained.

3-30. The receive input may be terminated or bridged across the circuit under test. The terminated mode provides a resistive termination on the receive circuit to provide proper loading. When a termination is provided by some other device, then it is not necessary (nor desirable) to provide a termination. In this case the receive input is used in the bridged mode, which provides a high impedance receive input (greater than 50k-ohms).

3-31. The 4943A input and output circuits are balanced to match standard telephone circuits. A balanced circuit is one that is electrically symmetrical; the two sides of the circuit have equal series resistance, series inductance, shunt capacitance, and leakage to ground. Only instruments with balanced inputs will operate properly when connected to a balanced circuit.

3-32. To allow dialing, talking, and listening over the circuit under test, handset terminals (DIAL) are provided for the connection of a lineman's handset. In addition, a +15V source (talk battery) is selectable for series application to the handset terminals. This allows the handset to become an ac signal source for application to the circuit under test.

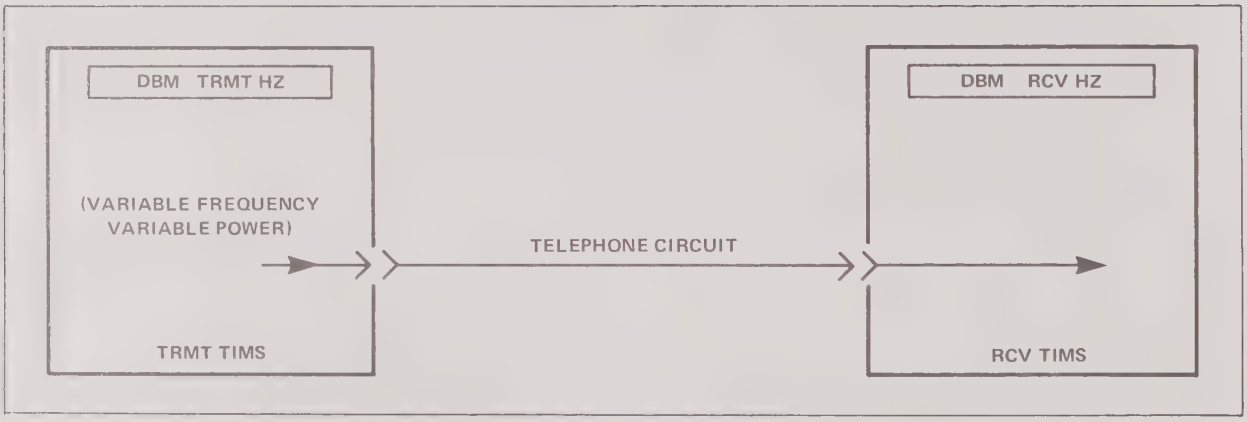


Figure 3-5. Level and Frequency Measurement

3-33. LEVEL AND FREQUENCY MEASUREMENTS

3-34. The level and frequency mode allows measurement of 1000 Hz loss (or gain) and attenuation distortion. These measurements define the amplitude-versus-frequency response of a telephone circuit. Figure 3-5 illustrates the basic setup for these measurements.

3-35. 1000 Hz LOSS. The 1000 Hz loss measurement determines the point-to-point loss (or gain) of a 1000 Hz test frequency transmitted over a telephone circuit. To make this measurement, a 1004 Hz test frequency is transmitted at one end of the circuit, and its power (in dBm) is measured at the other end. The transmitted power is compared with the received power to determine 1000 Hz loss.

3-36. The transmitted frequency is actually 1004 Hz (not 1000 Hz) to prevent measurement errors which would occur over certain telephone circuits. The 4943A offsets all stepped transmitter frequencies by 4 Hz.

3-37. ATTENUATION DISTORTION. The attenuation distortion measurement determines the amplitude-versus-frequency characteristics of a telephone circuit; using a single frequency measurement technique. To make this measurement, a 1004 Hz test frequency is transmitted. At the receiving end, the received power is recorded to obtain a 1004 Hz reference level. The transmitted frequency is then varied over the full transmitter range (while maintaining a constant transmitted level), and the received power is noted in each case. The received powers may then be compared to the 1004 Hz received reference power to obtain the frequency attenuation characteristics of the circuit in dBm.

3-38. To directly obtain the loss deviations relative to 1004 Hz, the LEVEL ZERO switch is depressed during reception of the 1004 Hz reference signal. This action stores the received power in dBm and simultaneously displays this level as 0 dB. Level readings taken at other frequencies will then be displayed in units of dB as compared to the 1004 Hz reference. This eliminates the need to subtract the 1004 Hz reference level from other levels at other frequencies to obtain dB readings.

3-39. According to telephone industry convention, attenuation distortion is defined as a change in loss of a telephone circuit, compared to the loss of a nominal 1000 Hz signal on that circuit. For example, a circuit with 6 dB more loss at 2800 Hz would have an attenuation distortion of +6 dB.

3-40. The SF (single-frequency) SKIP setup switch is provided to automatically prevent the test set from transmitting frequencies within the range of 2450 Hz to 2750 Hz. This feature is used in attenuation distortion and envelope delay to prevent the dropping out of the telephone circuit connection.

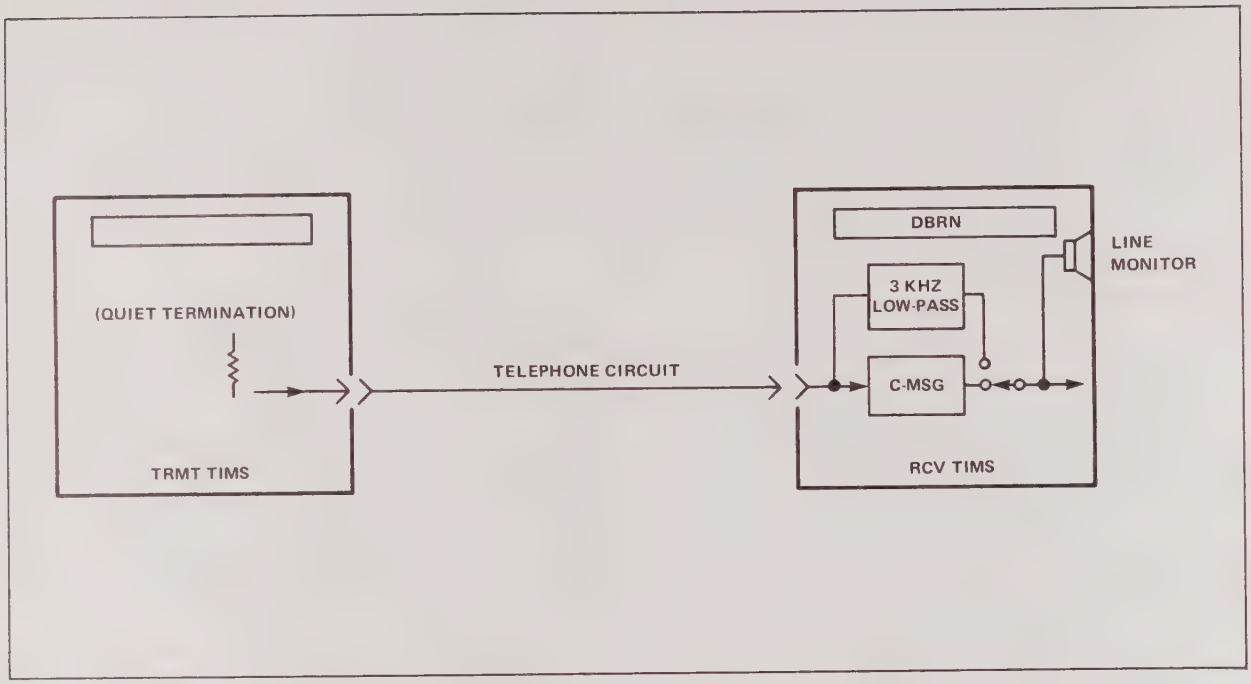


Figure 3-6. Message Circuit Noise Measurement

3-41. MESSAGE CIRCUIT NOISE MEASUREMENT

3-42. The message circuit noise mode allows measurement of the electrical noise on a telephone circuit. Figure 3-6 illustrates the basic setup for this measurement.

3-43. The message circuit noise mode measures the noise on a telephone circuit, which has a quiet termination on one end (supplied by transmitting TIMS) and a weighted measuring device on the other end (receiving TIMS). The quiet termination is a simple resistive termination on the wire pair.

3-44. At the measurement end of the telephone circuit, TIMS includes a frequency weighting (shaped) filter, either C-message or 3 kHz flat (see Figures 3-7 and 3-8). The C-message filter allows measurement of only those noise signals that are of annoyance to the "typical" subscriber of standard telephone service. The 3 kHz flat filter has a response that provides much less attenuation to the low frequencies (60 Hz to 500 Hz) as compared to the C-message filter. By comparing a 3 kHz flat noise measurement to a C-message noise measurement, the relative influence of low frequency noise (60 Hz commercial power, etc.) can be determined.

3-45. Received noise levels are displayed in units of dBrn, or dB with respect to reference noise (1000 Hz tone at –90 dBm). For example, a noise reading of 20 dBrn has an RMS power of –70 dBm (20-90 = –70). With the C-message filter, displayed readings are in units of dBrnC, or noise level in dBrn with a C-message weighted measuring device.

3-46. In addition to measuring noise on a telephone line, the 4943A may be used to listen to that noise. The line monitor speaker provides an amplified reproduction of the signal present at the filter output.

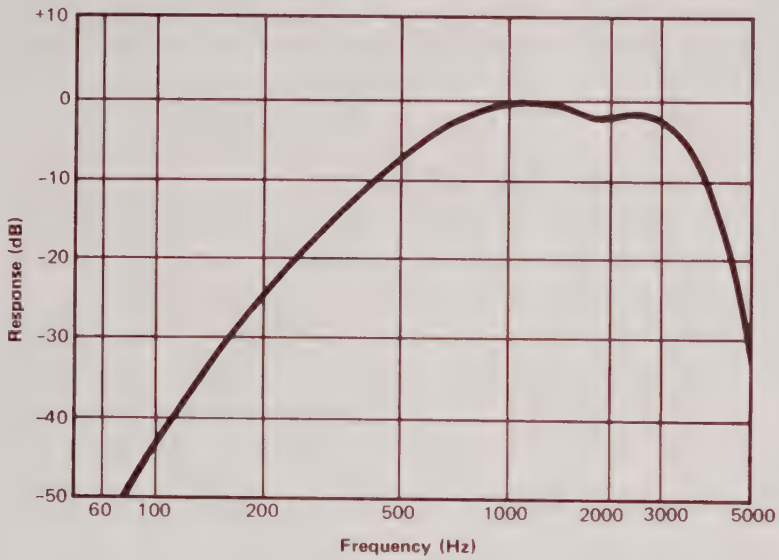


Figure 3-7. C-Message Weighting Characteristic

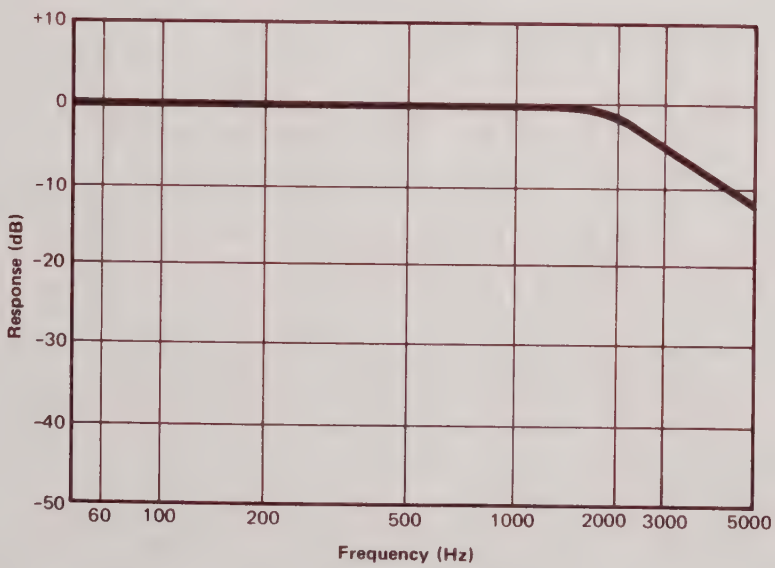


Figure 3-8. 3 kHz Flat Weighting Characteristic

3-47. NOISE-WITH-TONE MEASUREMENT

3-48. The noise-with-tone mode allows measurement of telephone circuit noise in the presence of a transmitted test frequency.

3-49. To make this measurement, a 1004 Hz test frequency is transmitted. At the receiving TIMS, the 1004 Hz signal is selectively attenuated by 50 dB using a notch filter (all frequencies between 995 Hz and 1025 Hz are attenuated by at least 50 dB). The remaining received signal (noise) is passed through a C-message filter for measurement. The received noise level is displayed in units of dBrn. Figure 3-9 illustrates the combination of the C-message weighting and notch filter characteristics.

3-50. SIGNAL-TO-NOISE MEASUREMENT

3-51. The signal-to-noise mode allows measurement of the ratio of received signal-plus-noise power to noise power (S + N/N).

3-52. To make this measurement, a 1004 Hz test frequency is transmitted over the telephone circuit. At the receiving TIMS, the 1004 Hz signal is selectively attenuated by 50 dB using the notch filter. The remaining received signal (noise) is then compared with the original signal-plus-noise signal. The computed signal-to-noise ratio is then displayed in units of dB. Figure 3-10 illustrates this measurement.

3-53. IMPULSE NOISE MEASUREMENT

3-54. This measurement mode allows a count of the impulse noise spikes over a selected time interval.

3-55. Impulse noise is that component of the received noise signal which is much greater in amplitude than the normal peaks of the message circuit noise. It occurs as short duration spikes and/or bursts of energy. Waveform (b) in Figure 3-11 illustrates a received test signal that includes interfering impulse noise spikes.

3-56. The impulse noise measurement allows determination of impulse noise count on a telephone circuit, given a selected amplitude threshold level and a selected measurement period. The 4943A is internally programmed to register a maximum of 7 counts per second. This arrangement agrees with the Bell Telephone System measurement standard.

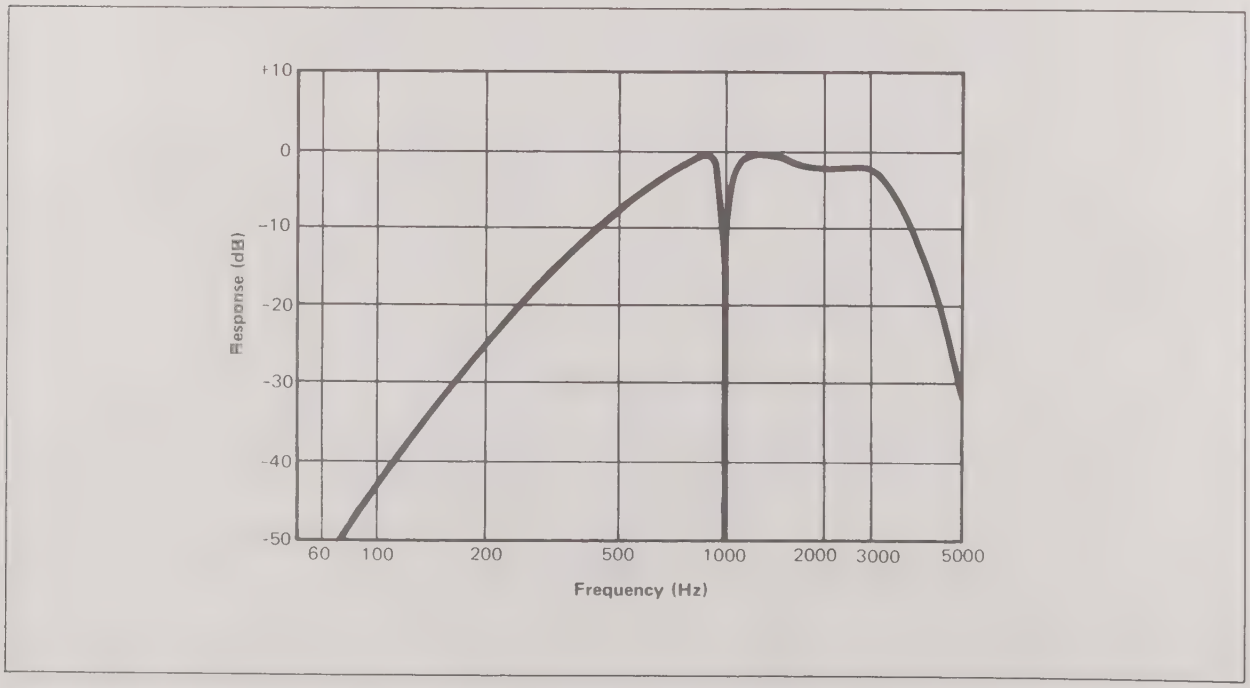


Figure 3-9. C-Message Weighting with Notch

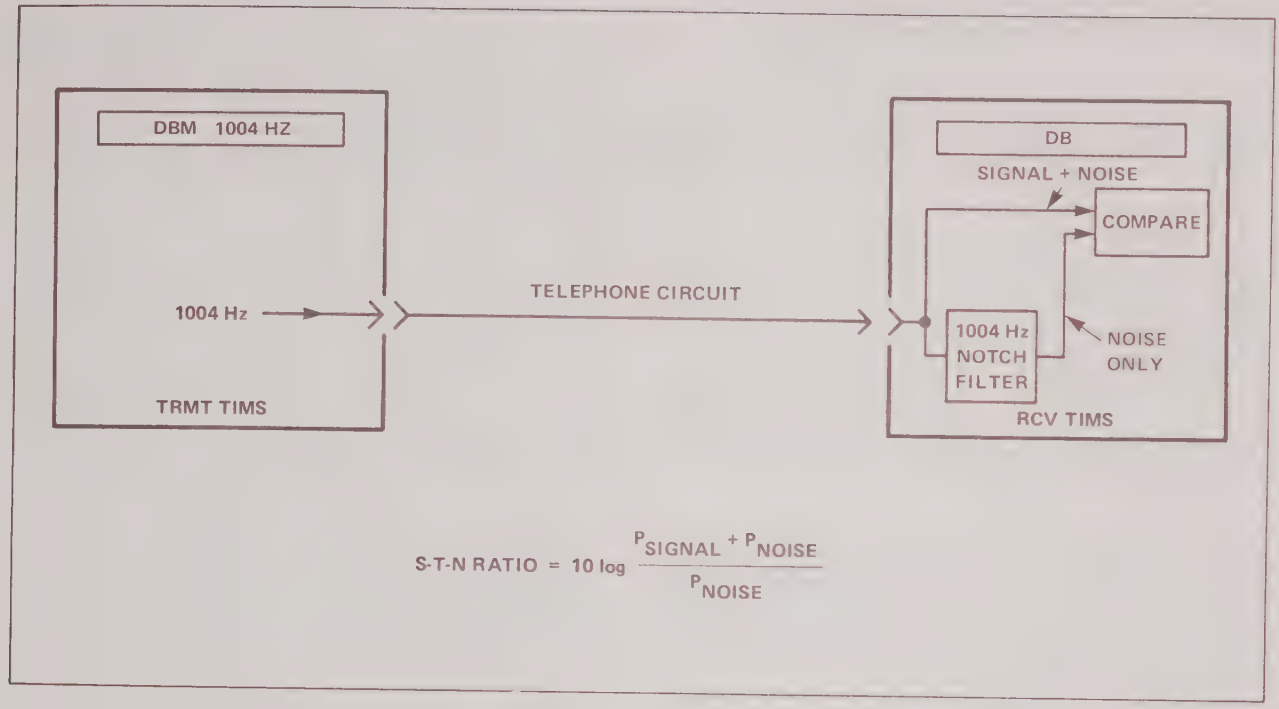


Figure 3-10. Signal-to-Noise Measurement

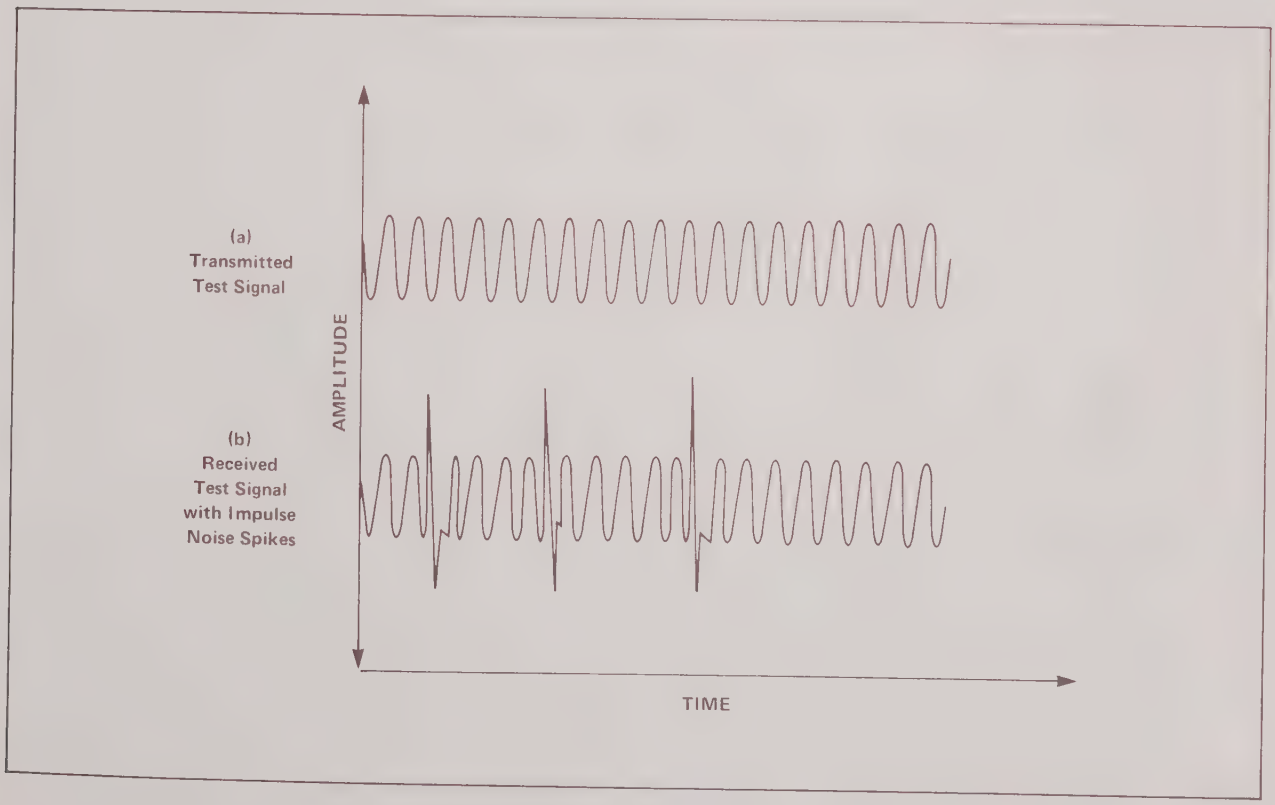


Figure 3-11. Impulse Noise Waveforms

3-57. ENVELOPE DELAY MEASUREMENT

3-58. The envelope delay mode allows measurement of the phase-versus-frequency characteristics of a telephone circuit.

3-59. An ideal circuit which has a linear phase shift characteristic will produce a straight line slope. This slope represents a linear relationship between a change in frequency and a corresponding change in phase as shown in Figure 3-12a. The practical circuit, however, is never ideal and will produce a nonlinear phase shift characteristic (phase distortion) as shown in Figure 3-12b.

3-60. Conventional measurement techniques make it difficult to measure the absolute phase characteristic of a transmission system, since a phase reference is difficult to establish at the receiving end of the circuit. It is possible, however, to measure relative phase shift at the receiving end using the envelope delay measurement technique. This technique makes it possible to measure the envelope delay distortion of a telephone circuit, which provides a relative measure of the phase linearity (or non-linearity) of the circuit.

3-61. RELATING PHASE SHIFT TO ENVELOPE DELAY. Amplitude modulating a low frequency sine wave (f_m) onto a carrier frequency (f_c) produces an amplitude modulated (AM) signal as shown by waveforms (a), (b), and (c) in Figure 3-13. The envelope of the AM signal is the outline (or shape) of the peak excursions of the modulated signal as shown in waveform (d) of Figure 3-13. The AM process produces a signal whose spectrum consists of the carrier frequency plus an upper sideband ($f_c + f_m$) and a lower sideband ($f_c - f_m$). Figure 3-14 illustrates this relationship. Since the upper sideband is of a higher frequency than the carrier, it undergoes a greater phase shift than the carrier; since the lower sideband is of a lower frequency, it undergoes less phase shift.

3-62. If the AM signal is passed through a circuit having a phase shift characteristic which increases linearly with frequency (Figure 3-12a), the envelope of the AM signal experiences a shift in time (or delay) as shown in waveforms (d) and (e) of Figure 3-13. This occurs because the lower sideband experiences less phase shift than the carrier, while the upper sideband encounters more. The net result of these phase shifts is that the modulation envelope is shifted in phase (or delayed) when traveling over a transmission medium.

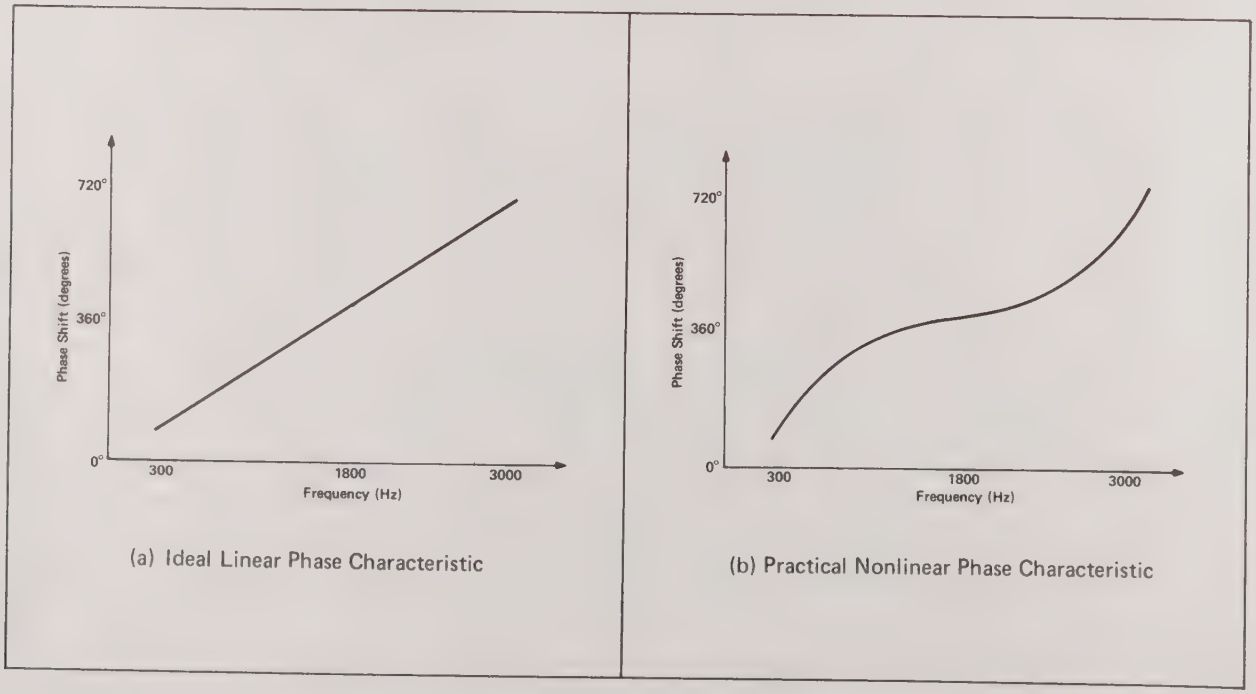


Figure 3-12. Phase-versus-Frequency Relationships

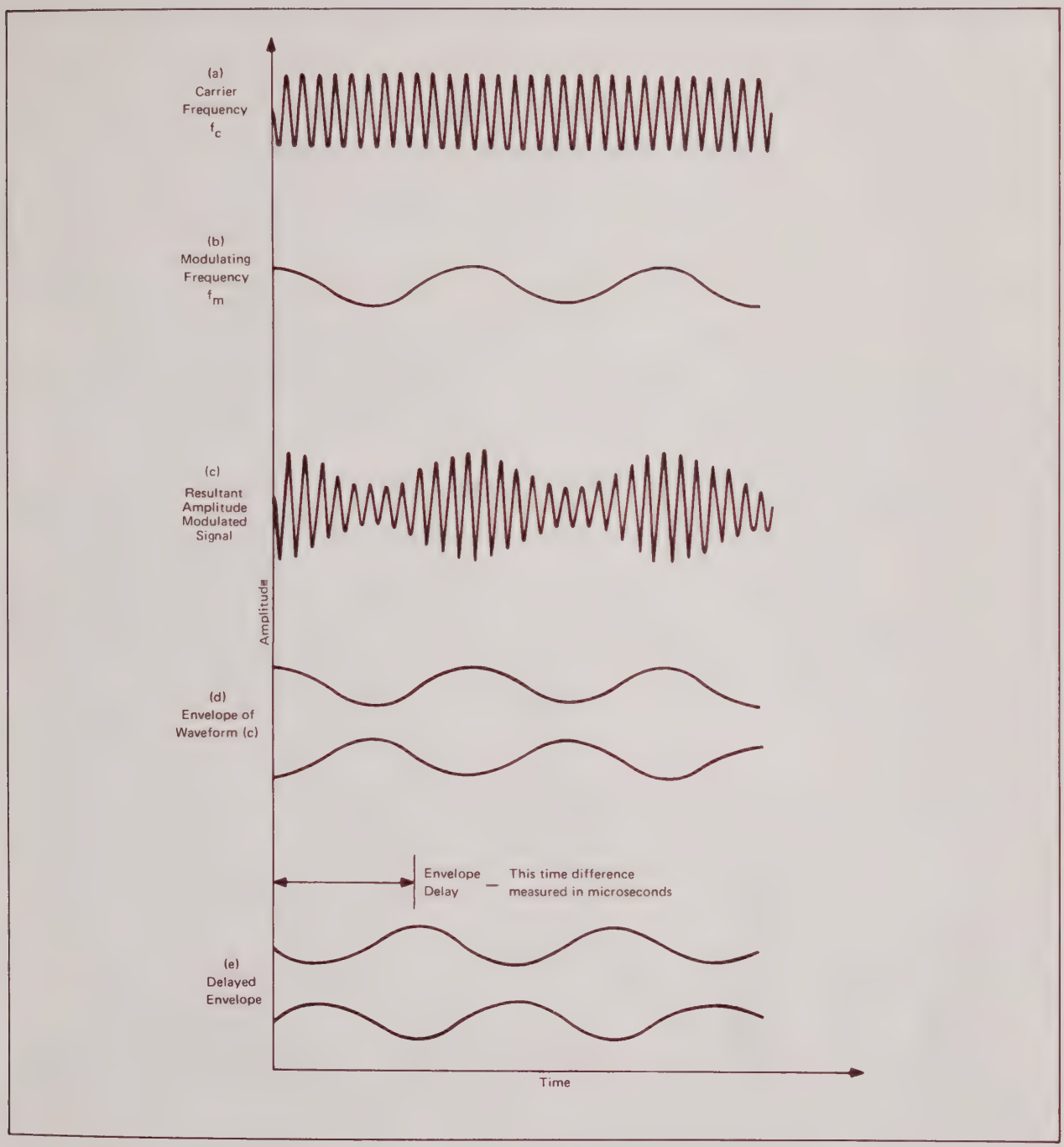


Figure 3-13. Envelope Delay Waveforms

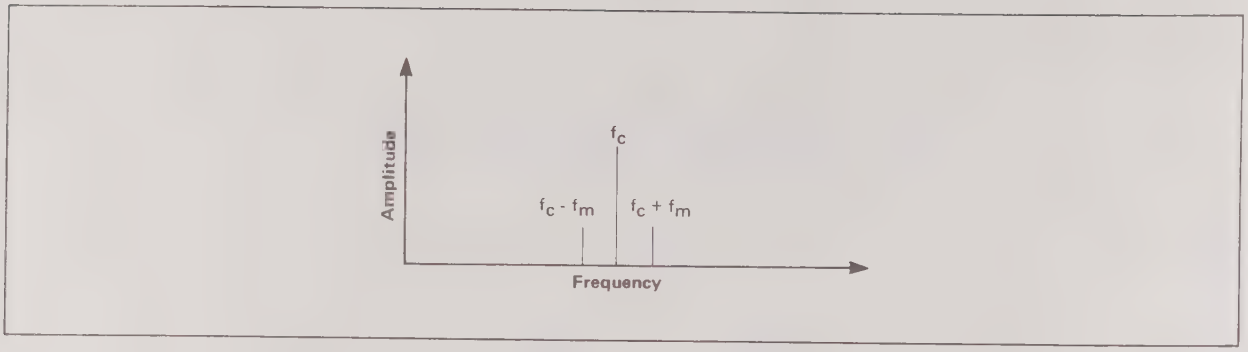


Figure 3-14. AM Signal Frequency Spectrum

3-63. The amount of envelope delay is related to the difference in phase between the two sidebands. If the phase-versus-frequency characteristic of the transmission medium is linear, then any carrier frequency used (with a fixed modulation frequency) will produce a constant envelope delay value. Plots (a) and (b) in Figure 3-15 illustrate this. However, if the phase-versus-frequency characteristic is nonlinear, then different carrier frequencies will produce different envelope delay values. Plots (c) and (d) in Figure 3-15 illustrate this. *When different values of envelope delay occur, the difference between delay values at two different carrier frequencies is termed "envelope delay distortion".*

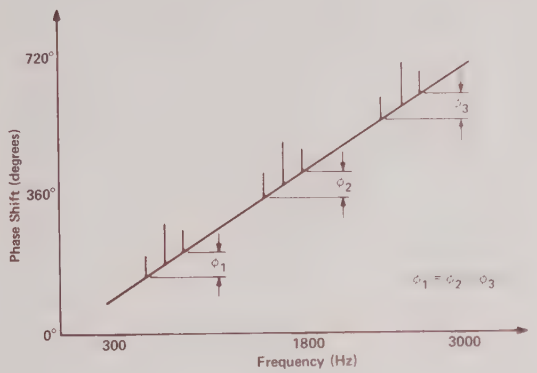
3-64. ENVELOPE DELAY MEASUREMENT TECHNIQUE. To make this measurement, two test sets are used in the configuration shown in Figure 3-16. The normal set transmits a test signal over the circuit under test to the repeat set. The repeat set responds by transmitting envelope delay information back to the normal set over the return reference circuit. The normal set compares its received signal with its transmitted signal to determine envelope delay distortion values.

3-65. The normal set transmits an amplitude modulated test signal consisting of a variable frequency carrier (204 to 3904 Hz) and a fixed modulation frequency (83-1/3 Hz). The carrier frequency is varied over the band of interest, usually in 100 Hz steps. The test signal travels the circuit under test and is received by the repeat set. The receiver of the repeat set amplitude demodulates the incoming test signal to produce the AM envelope. Changing the carrier frequency as mentioned above will result in a change in the delay of the 83-1/3 Hz envelope at the repeat set, if envelope delay distortion exists. The envelope delay values received at the repeat set must now be transmitted back to the normal set for measurement.

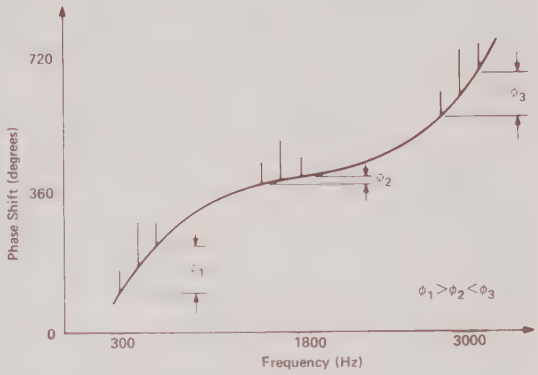
3-66. In the repeat set, the demodulated AM signal is used to amplitude modulate the fixed frequency carrier that is transmitted back to the normal set. The repeat set carrier oscillator remains fixed at one frequency during the envelope delay measurement. The carrier frequency is usually selected at midband (nominally 1804 Hz) because envelope delay characteristics are fairly constant and attenuation distortion characteristics are fairly flat. Since a constant return frequency is used by the repeat set, there will be no envelope delay distortion encountered by the return reference signal (although there will be a fixed envelope delay). Therefore, the envelope delay value received at the normal set will represent the envelope delay value received at the repeat set, plus the constant envelope delay of the return reference circuit.

3-67. The receiver of the normal set then amplitude demodulates the incoming return reference signal. The phase of the incoming return reference envelope is then compared with the original 83-1/3 Hz oscillator signal to determine the difference in phase (envelope delay) between the two signals.

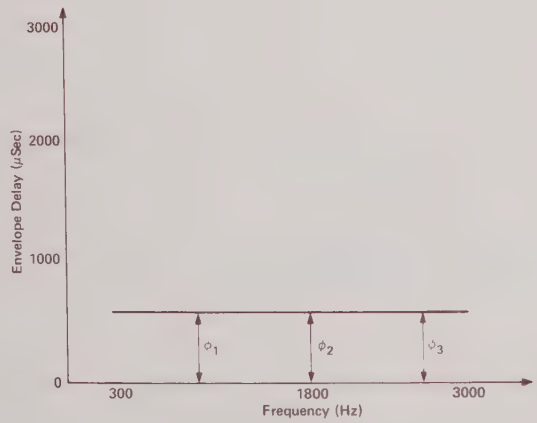
3-68. To measure the change in envelope delay from the normal set to the repeat set (with a change in carrier frequency), a DELAY ZERO control is used to "zero out" the fixed envelope delay of the entire measurement loop. The delay zero control sets the phase difference (or envelope delay) between the 83-1/3 Hz oscillator and the return reference envelope to zero. This zeroing is usually done at a normal set transmit frequency of



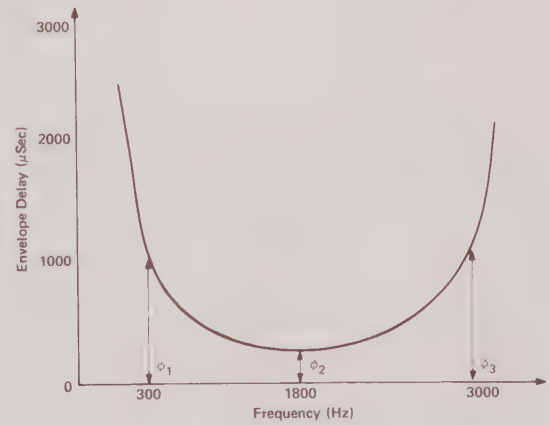
(a) Linear Phase Characteristic with Superimposed AM Signal Components



(c) Nonlinear Phase Characteristic with Superimposed AM Signal Components



(b) Envelope Delay Characteristic of (a) above.



(d) Envelope Delay Characteristic of (c) above.

NOTE: The symbol phi (ϕ) represents the difference in phase between the upper and lower sidebands of the AM signal superimposed on the phase characteristic plots.

Figure 3-15. Relating Phase Shift to Envelope Delay

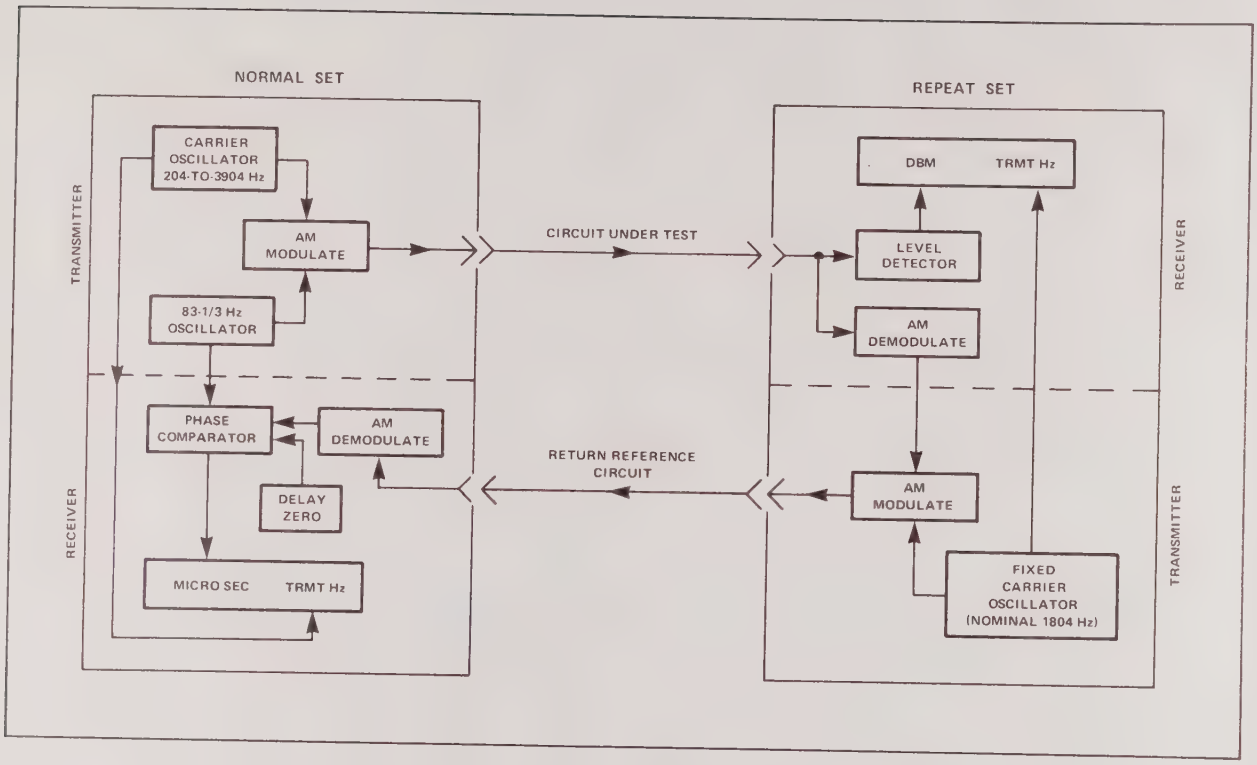


Figure 3-16. Envelope Delay Measurement

1804 Hz. All future envelope delay measurements will then be referenced to the 1804 Hz carrier frequency of the normal set. By changing the normal set carrier frequency from the delay zero reference value, the only changing envelope delay (envelope delay distortion), occurring in the measurement loop, is that incurred by the test signal on the circuit under test.

3-69. RETURN REFERENCE OR FORWARD REFERENCE OPERATION

3-70. The envelope delay measurement may be performed using th e 4943A in either the forward or return measurement mode. *The terms "forward" and "return" refer to the direction of the "reference carrier signal", with respect to the normal test set.* Figure 3-16 in the previous text illustrated the return reference arrangement in detail. It is possible, however, to make the measurement with the normal set generating the reference carrier signal. In both cases, the normal set makes the actual measurement while the repeat set transfers the incoming 83-1/3 Hz modulation onto its transmitted carrier.

3-71. The advantage of using both techniques is in getting all measurement data at one end of the telephone circuit. Figure 3-17 shows how this is done.

3-72. In Figure 3-17a, the variable frequency carrier is sent by the normal set to the repeat set. In (b), the variable frequency carrier is sent by the repeat set. In both cases, the repeat set functions as a repeater for the 83-1/3 Hz modulation. In both cases the normal set measures the change in envelope delay (in microseconds). Therefore envelope delay distortion can be measured in either case.

3-73. The normal set is in essence detecting the changing envelope delay where the carrier is changing. In Figure 3-17a, the normal set measures the distortion in the forward direction. In (b), the normal set measures in the return direction.

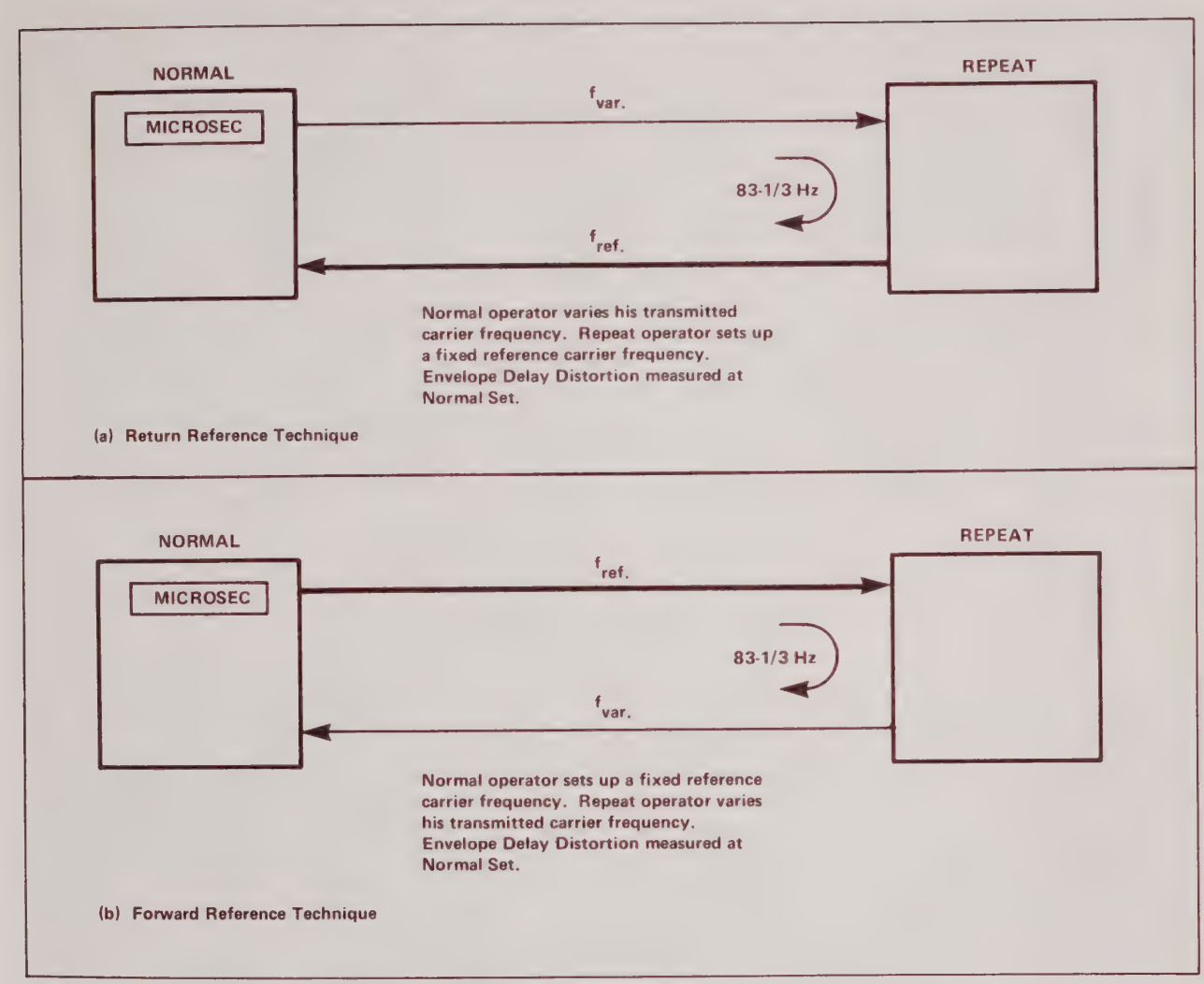


Figure 3-17. Return and Forward Reference

3-74. PHASE JITTER MEASUREMENT

3-75. The phase jitter mode allows measurement of the peak-to-peak phase deviation on a telephone circuit. Phase jitter is the undesired component of a received signal which appears as phase (or frequency) modulation. Figure 3-18 illustrates the effect of phase jitter on a reference test signal.

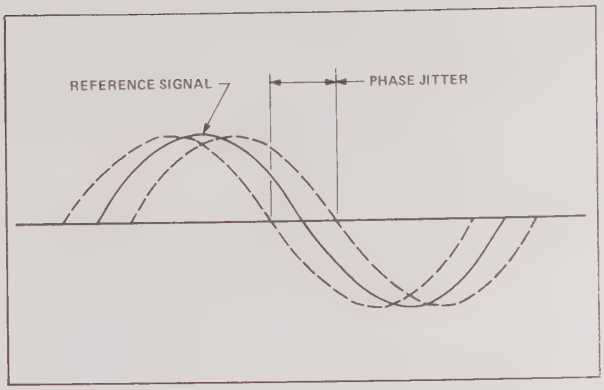


Figure 3-18. Effect of Jitter on Test Signal

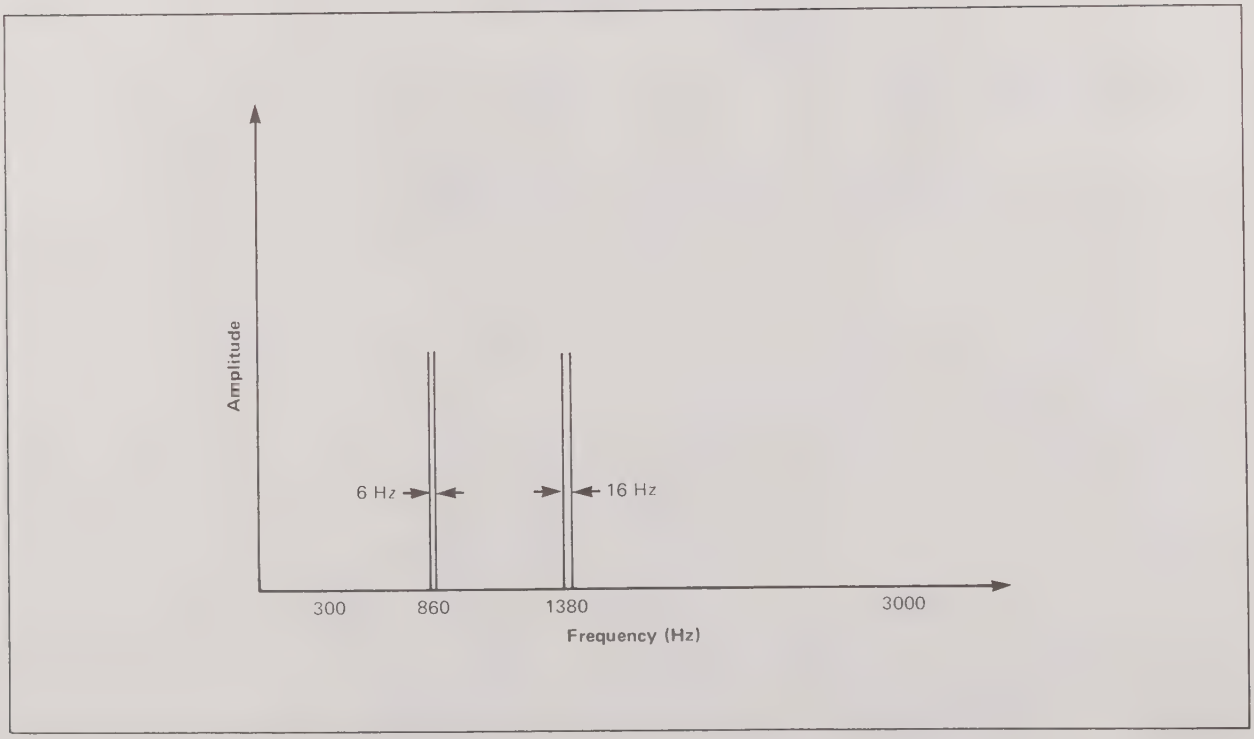


Figure 3-19. Nonlinear Distortion Transmit Signal Frequency Spectrum

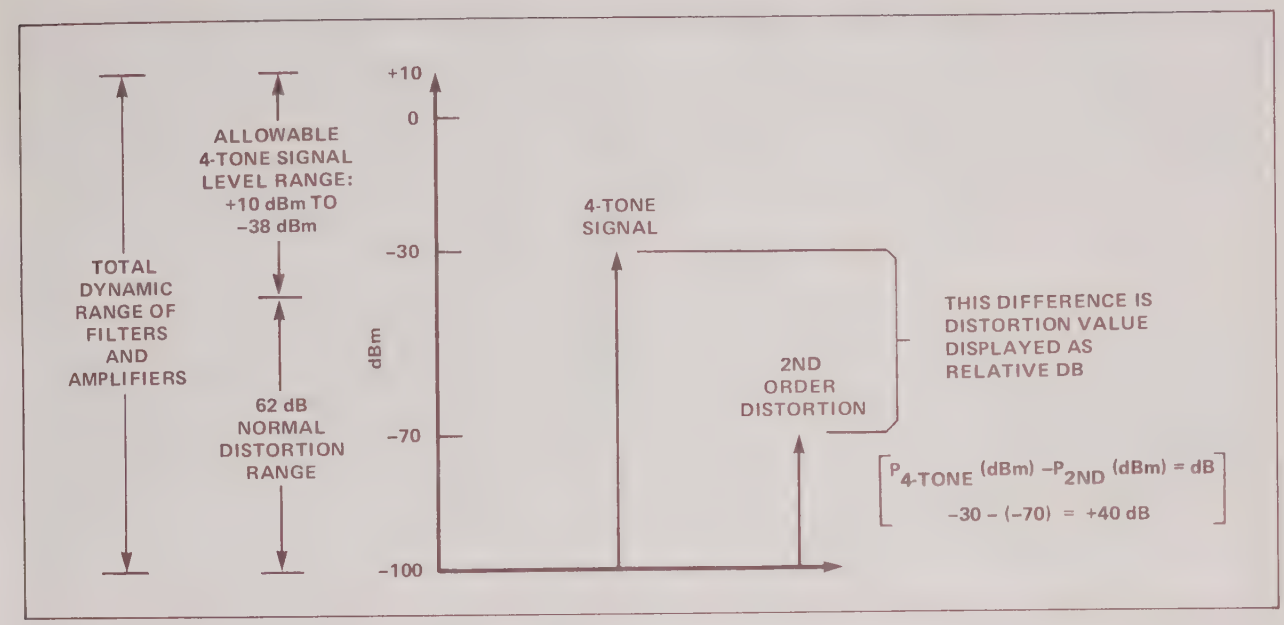


Figure 3-20. Nonlinear Distortion Levels

3-76. NONLINEAR DISTORTION MEASUREMENT (OPTION 012)

3-77. The nonlinear distortion (NLD) mode allows measurement of the second and third order intermodulation distortion products of two test frequency pairs transmitted over a telephone circuit.* Figure 3-19 illustrates the spectrum of the transmitted nonlinear distortion test signal.

3-78. Nonlinear distortion is the generation of new signal components not present in the original transmitted signal. This usually happens when a circuit's loss is nonlinear with respect to input level.

3-79. With a single frequency (f_1) applied to the input of a nonlinear device, the nonlinear distortion appears as harmonics of the input frequency, such as $2f_1$, $3f_1$, $4f_1$, etc. This type of distortion is termed "harmonic distortion". With a multiple frequency signal (f_1 and f_2) applied to the device input, the nonlinear distortion appears as harmonics of the individual input frequencies plus intermodulation products of the input frequencies. This type of distortion is termed "intermodulation distortion", and is the type measured by TIMS. Bell Telephone Laboratory studies have shown that it is valid to measure the power sum of the distortion products $f_1 + f_2$ (2240 Hz) and $f_2 - f_1$ (520 Hz) as representative of the second order distortion, while $2f_2 - f_1$ (1900 Hz) may be measured as representative of the third order distortion; which is the technique utilized by TIMS.

3-80. The check signal provision is included in TIMS to permit correction of error caused by the presence of high background noise. When the NLD toggle switch is momentarily thrown to the CHECK position, the second tone pair shown in Figure 3-19 (as centered at 1380 Hz) is suppressed, and the lower tone pair is doubled in power. This allows the circuit to be checked with a test signal of the same power. Without the two tone pairs being generated, the intermodulation process (as measured by TIMS) does not occur. The receiving TIMS looks for the second and third order products, but since these are not present, the measured received signals consist of noise. The second and third order products as measured with the two tone pairs may then be corrected accordingly to achieve accurate values.

3-81. The objective is in obtaining the amplitude relationship between second order products (or third) and the fundamental frequencies. Figure 3-20 attempts to show this relationship, plus show the acceptable signal levels. The measured 4-tone signal power and distortion power will both

*This non-linear distortion analyzer circuit is licensed under Hekimian Laboratories, Inc. U.S. Patent No. 3,862,380.

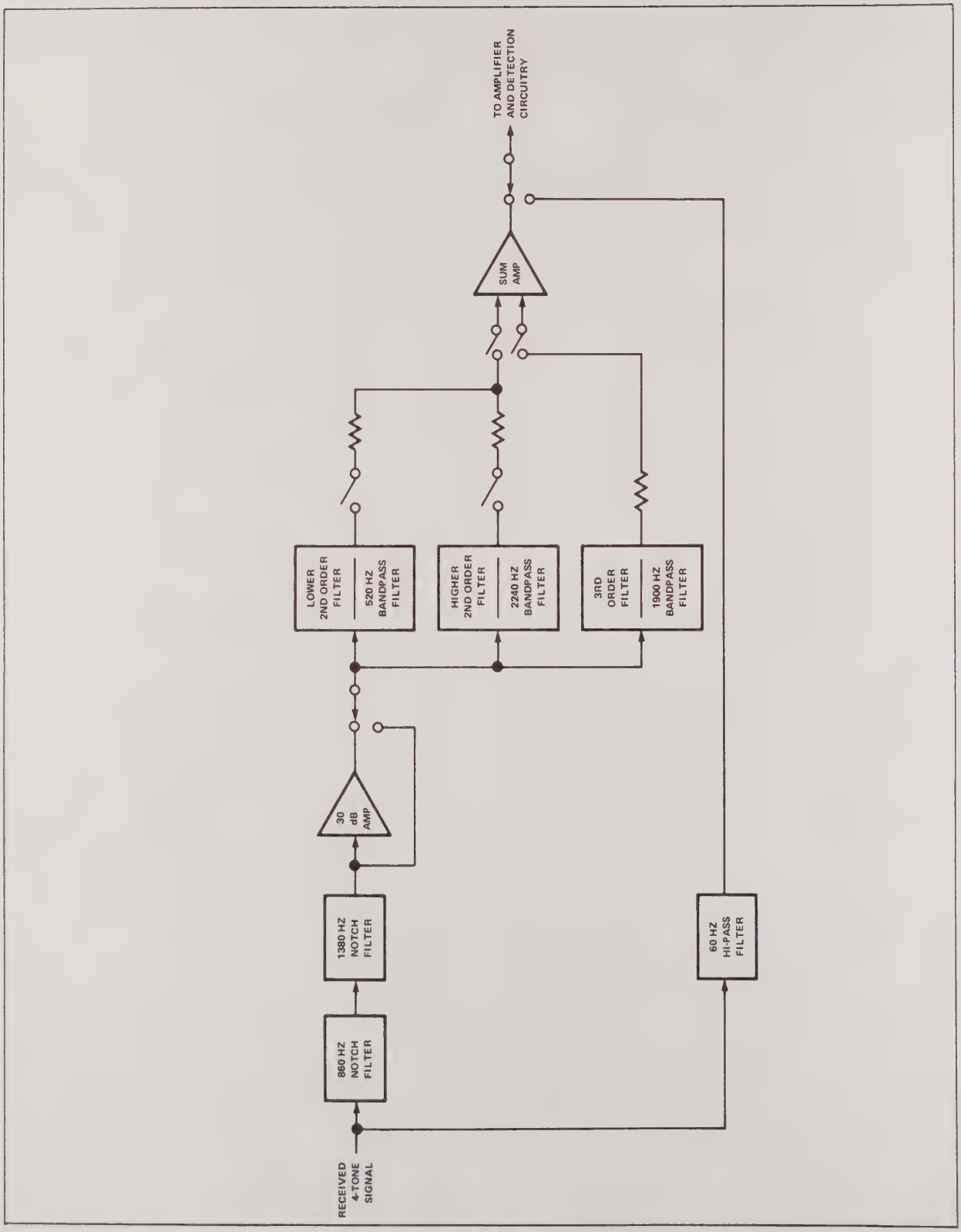


Figure 3-21. Nonlinear Distortion Measurement Technique

normally have a negative sign (–dBm). However, when their difference is computed, a positive value results [–30 – (–70) = +40 dB]. Less distortion gives a larger number of dB spread, more gives a smaller number.

3-82. MEASUREMENT TECHNIQUE. The basic measurement technique is shown in Figure 3-21. The first measurement is of the total 4-tone signal, including distortion. All the distortion filters are bypassed through the 60 Hz high-pass filter. The two second order products are then selected for comparison with the 4-tone signal. These two measured values are in absolute dBm, and as yet undisplayed. They are compared to find th e relative dB value for display. Finally, the third order product is measured for similar comparison and display.

3-83. When the NLD CHECK switch is depressed, no distortion products are produced. So what passes through the second and third order filters is noise. Various decision-action paths are taken, according to how much noise power is found. Table 3-7 attempts to organize the complex set of results.

3-84. If the noise levels are at least 10 dB below the distortion, the distortion values are accepted as-is. If the noise is from 10 dB below to 2 dB below, the measured distortion values receive a correction factor. If the noise is from 2 dB below to any value over, then the measured distortion is considered t o be noise.

Table 3-7. Nonlinear Distortion Correction Process

NOISE LEVELS RELATIVE TO DISTORTION LEVELS	DECISION MADE BY TIMS	DISPLAY INDICATION*
10 dB below or lower	Measured 4 tone distortion values are valid without correction.	No change in displayed data from 4 tone to 2 tone test. No flashing "2" or "3". No minus signs.
10 dB below up to 2dB below	Measured distortion values need be corrected. NOISE LEVEL BELOW DISTORTION : CORRECTION FACTOR TO DISTORTION <1.9 dB : noise decision below 1.9 to 2.6 dB : 4 dB added 2.6 to 3.7 dB : 3 dB added 3.7 to 5.3 dB : 2 dB added 5.3 to 9.6 dB : 1 dB added >9.6 dB : 0 dB added	Display data changes from 4 tone to 2 tone values according to table at left (changes from intermediate to corrected values).
2 dB below to above distortion	Measured 4 tone distortion values are considered to be noise.	"2" and "3" displays continue flashing after "CORRECTED" annunciator comes on.

*A minus sign (–) after either "2" or "3" display indicates a noise or distortion underrange. A flashing "2" or "3" with minus sign is a noise underrange. A solid "2" or "3" with minus sign is a distortion underrange.

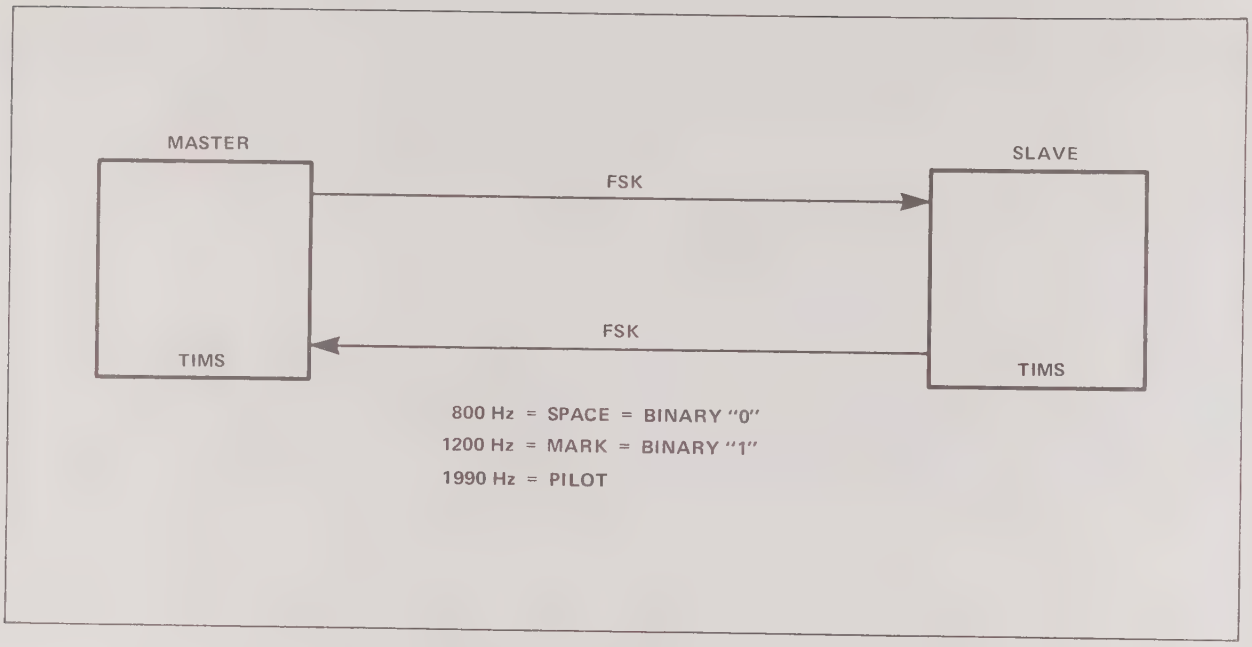


Figure 3-22. FSK Communication

3-85. MASTER-SLAVE OPERATION

3-86. The master-slave feature of the Model 4943A allows remote control of the slave unit by the master unit. The front panel NORMAL-MASTER-SLAVE switch selects the mode of operation for a particular unit. When set to NORMAL, the test set is manually controlled. When set to MASTER, the test set controls the operation of itself and the slave. When set to SLAVE, the front panel controls are disabled except for the TRANSMITTER OUTPUT LEVEL control, the IMPULSE NOISE THRESHOLD switch, and the SETUP CONTROLS.

3-87. HANDSHAKE ROUTINE. The master unit links up with the slave unit by performing a "handshake" routine. The two units "shake hands" or "talk" to each other over the telephone circuit, using frequency shift keying (FSK). The FSK scheme employed is an 800-1200 Hz shift (see Figure 3-22). The 1200 Hz signal represents a mark (binary 1) while the 800 Hz signal represents a space (binary 0). A 1990 Hz signal accompanies the FSK signal and serves as its pilot. This pilot serves to "alert" the receiving unit that FSK is arriving. The FSK pilot is used to confirm the presence of FSK data, and therefore helps prevent the erroneous reception of noise as data bits.

3-88. The master unit begins the routine by sending a group of data bits (a command) to the slave. These bits represent the measurement mode and direction of test (i.e., Level & Frequency, MASTER-TO-SLAVE). After the group of bits are received by the slave, the slave sends the same bit group back to the master. The master compares its originally transmitted message with its received message to check for proper reception.

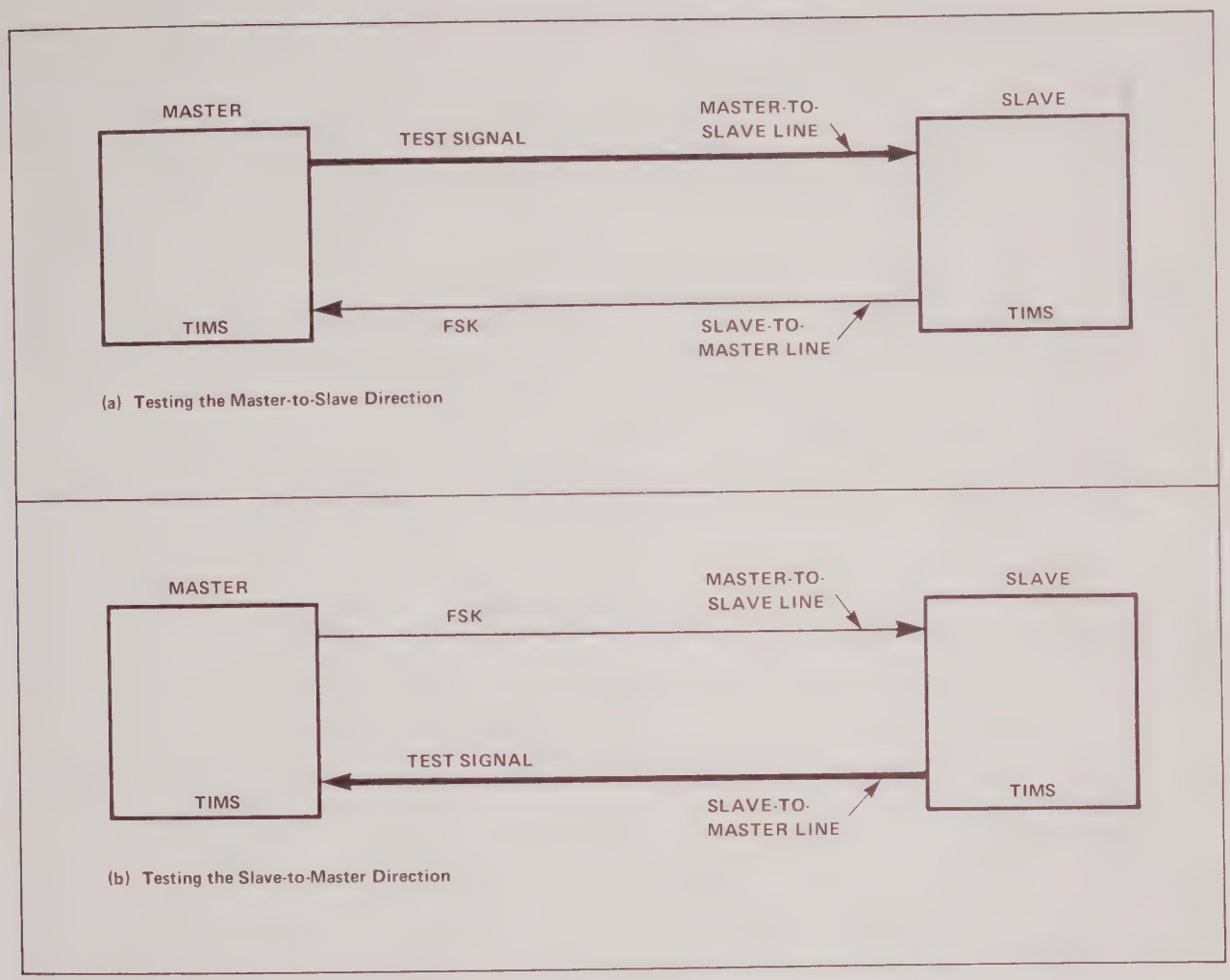


Figure 3-23. Direction of Test

3-89. DIRECTION OF TEST. There are two transmission paths between the master and slave units as shown in Figure 3-23. To test the path from master to slave, the REMOTE switch is set to the MASTER TO SLAVE position. The master then "tells" the slave that it will be receiving a test signal. The slave in turn will "talk" to the master to "tell" it the measured test values at the slave. The master will then display the test values measured by the slave.

3-90. Testing the opposite direction is accomplished by positioning the REMOTE switch to SLAVE TO MASTER. The master sends instructions to the slave unit on the master-to-slave path and measures the test signal sent from the slave.

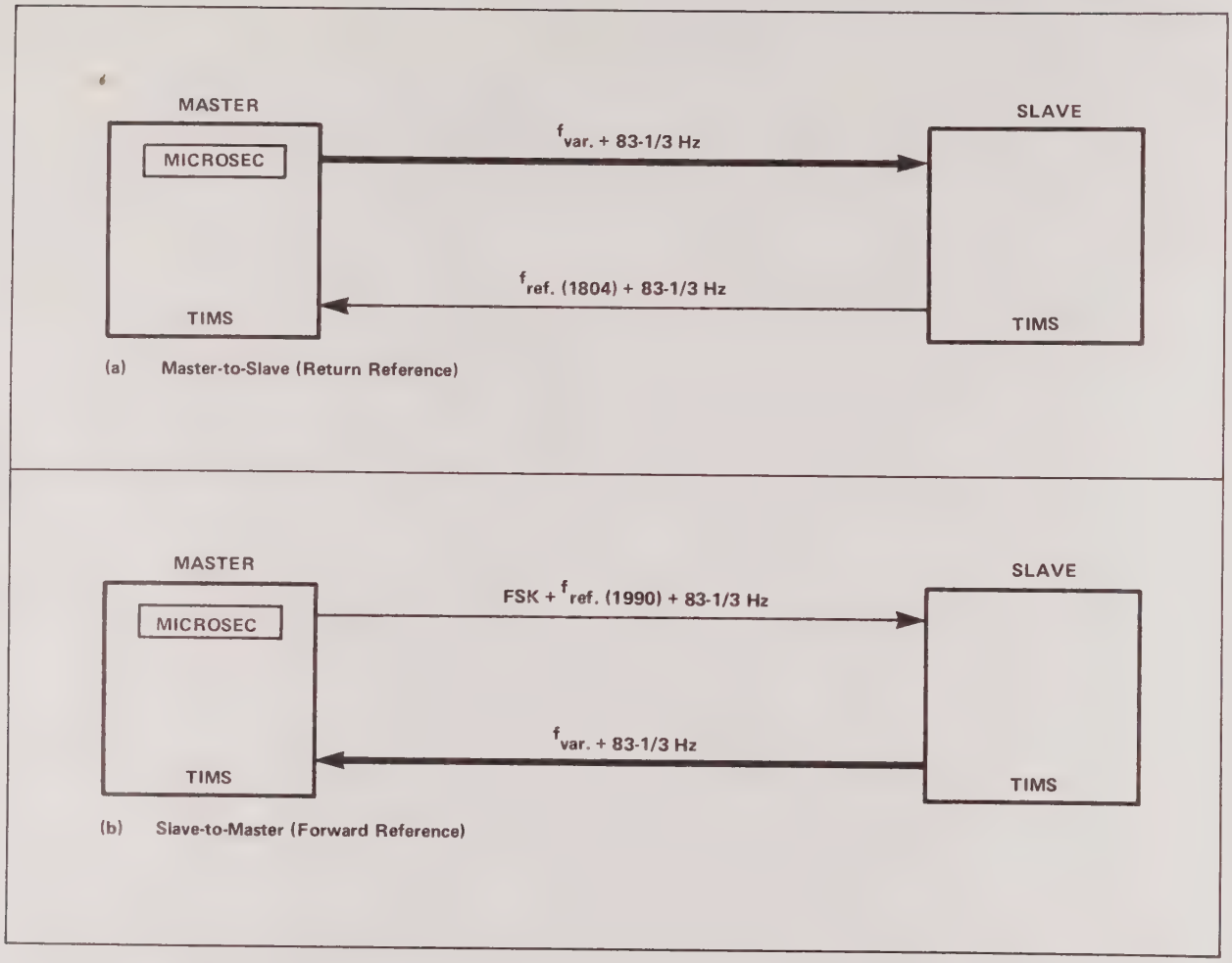


Figure 3-24. Envelope Delay Using Master-Slave

3-91. ENVELOPE DELAY OPERATION. Envelope delay distortion is measured using master-slave operation as shown in Figure 3-24. To begin the measurement, the two units perform the "handshake" routine as described previously. The master unit initially "tells" the slave unit to act as a repeat set. The master then sends down the variable frequency carrier with its 83-1/3 Hz modulation. The slave in turn repeats the 83-1/3 Hz modulation onto a fixed reference frequency of 1804 Hz. Envelope delay is then measured at the master unit.

3-92. To measure in the slave-to-master direction, the master unit sends a composite signal made up of:

FSK . . . . . 800 ⟷ 1200 Hz

$f_{reference}$ (FSK PILOT). . . . . 1990 Hz

Modulation. . . . . 83-1/3 Hz

The FSK component is "telling" the slave unit to send back a particular carrier frequency. The presence of the 1990 Hz signal serves two purposes. First, it serves to "alert" the slave that FSK is arriving. Secondly, it serves as the fixed frequency carrier. The slave in turn repeats the 83-1/3 Hz onto its variable frequency carrier.

3-93. LINE LOOP BACK

3-94. In this application, the Model 4943A serves as an audio frequency repeater. What comes in goes back out. The test set is selective in that the frequency range passed is between 200 and 3904 Hz. The transmitted output level is selected by the test set operator within the normal range of the instrument.

3-95. This mode of operation is not front panel selectable. But rather, is automatically activated under certain conditions. These conditions occur during the master-slave mode, when incompatible measurements are attempted between differently configured instruments. For instance, this happens if the master unit is attempting a phase jitter measurement, and the slave is a 4943A-Option 012 (with NLD instead of phase jitter).

3-96. The slave would alert the master that it is not capable of making the phase jitter measurement. The slave would then configure itself into the loop back mode.

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SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the instrument's electrical performance using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is provided in Section III under Self Check Procedures.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for the performance tests is listed in the Recommended Test Equipment table in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

4-5. TEST RECORD

4-6. Results of the performance tests may be tabulated on the Test Record at the end of these procedures. The Test Record lists all of the tested specifications and their acceptable limits. The results recorded at incoming inspection can be used for comparison in periodic maintenance, trouble-shooting, and after repairs or adjustments.

4-7. CALIBRATION CYCLE

4-8. This instrument requires periodic verification of performance. Depending on use and environmental conditions, the instrument should be checked using the performance tests at least every six months. The performance tests may also be performed prior to any periodic calibration (suggested annually), to eliminate any unnecessary effort.

PERFORMANCE TESTS

NOTE

Perform Self Check procedures (Figure 3-2) before proceeding with any Performance Tests. It is necessary to verify instrument functional operation with the Self Check procedures, before beginning with the Performance Tests. The Performance Tests then verify that the instrument meets published specifications.

4-9. FREQUENCY RANGE TEST

SPECIFICATION:
Range: 200 Hz to 3950 Hz
Resolution: 1 Hz
Accuracy: ±0.5 Hz
SF Skip: 2450 Hz to 2750 Hz

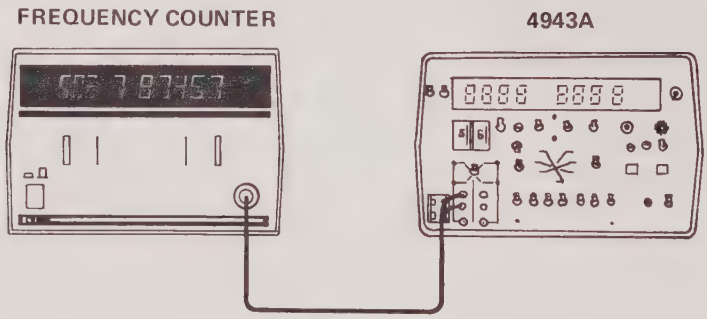

Figure 4-1. Frequency Range Test Setup

TEST EQUIPMENT REQUIRED: Frequency Counter.

SETUP CONDITIONS: 4943A

MEASUREMENT ..... LEVEL & FREQUENCY
DISPLAY TRMT/RCV ..... TRMT
SETUP CONTROLS ..... UP
TRMT/RCV JACKS ..... Left jack field TRMT
Right jack field RCV

PROCEDURE:

1. Adjust TRANSMITTER FREQUENCY to 204 Hz and TRANSMITTER OUTPUT LEVEL to +0.0 dBm. Verify that counter reads 204 ±0.5 Hz.
2. Adjust TRANSMITTER FREQUENCY to 3904 Hz. Verify that counter reads 3904 ±0.5 Hz.
3. Set the frequency control switch to MANUAL. Set the NO SF SKIP/SF SKIP switch to SF SKIP. Vary the TRANSMITTER FREQUENCY control through the frequency band. Verify a minimum frequency of 199 ±1 Hz, blank between 2450 ±1 Hz and 2750 ±1 Hz, and a maximum frequency of 3950 ±1 Hz.
4. Return all SETUP switches to UP position.

PERFORMANCE TESTS

4-10. OUTPUT LEVEL ACCURACY TEST (1 OF 2)

SPECIFICATION:
Range: +10 dBm to –40 dBm
Resolution: 0.1 dBm
Accuracy: ±0.1 dB
Frequency Response: ±0.1 dB from 200 Hz to 3904 Hz

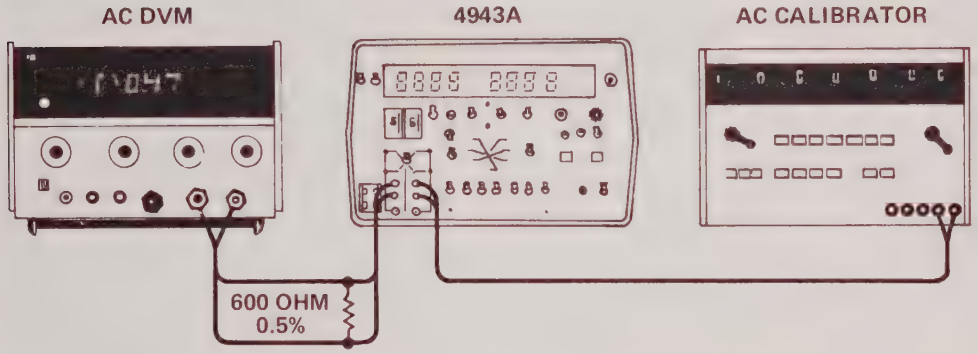

Figure 4-2. Output Level Accuracy Test Setup

TEST EQUIPMENT REQUIRED:
AC Calibrator, AC DVM, 600 ohm resistor.

SETUP CONDITIONS:
4943A
MEASUREMENT ..... LEVEL & FREQUENCY
DISPLAY TRMT/RCV ..... TRMT
SETUP CONTROLS ..... UP
TRMT/RCV JACKS ..... Left jack field TRMT
Right jack field RCV

AC Calibrator
Frequency ..... 1000 Hz
Amplitude ..... 774.6 mVac

PROCEDURE:

1. Adjust TRANSMITTER FREQUENCY to 1004 Hz and TRANSMITTER OUTPUT LEVEL for AC DVM reading of 774.6 mVac. Left display must read +0.0 ±0.1 dBm.

2. Connect AC Calibrator to RCV jacks. Set DISPLAY TRMT/RCV switch to RCV. Select each output level shown and verify reading in the left display:

AC Calibrator output	Left Display reading
774.6 mVac	+0.0 ±0.1 dBm
690.4 mVac	–1.0 ±0.1 dBm
615.3 mVac	–2.0 ±0.1 dBm
548.4 mVac	–3.0 ±0.1 dBm
488.7 mVac	–4.0 ±0.1 dBm
435.6 mVac	–5.0 ±0.1 dBm
388.2 mVac	–6.0 ±0.1 dBm
346.0 mVac	–7.0 ±0.1 dBm
308.4 mVac	–8.0 ±0.1 dBm
274.8 mVac	–9.0 ±0.1 dBm

PERFORMANCE TESTS

4-10. OUTPUT LEVEL ACCURACY TEST (2 OF 2)

AC Calibrator output	Left Display reading
244.9 mVac	−10.0 ±0.1 dBm
218.3 mVac	−11.0 ±0.1 dBm
194.6 mVac	−12.0 ±0.1 dBm
173.4 mVac	−13.0 ±0.1 dBm
154.6 mVac	−14.0 ±0.1 dBm
137.7 mVac	−15.0 ±0.1 dBm
122.8 mVac	−16.0 ±0.1 dBm
109.4 mVac	−17.0 ±0.1 dBm
97.52 mVac	−18.0 ±0.1 dBm
86.91 mVac	−19.0 ±0.1 dBm
77.46 mVac	−20.0 ±0.1 dBm
43.56 mVac	−25.0 ±0.2 dBm
24.49 mVac	−30.0 ±0.2 dBm
13.77 mVac	−35.0 ±0.2 dBm
1.377 Vac	+5.0 ±0.2 dBm
2.449 Vac	+10.0 ±0.2 dBm

PERFORMANCE TESTS

4-11. HARMONIC DISTORTION, SPURIOUS SIGNALS, AND BACKGROUND NOISE TEST

SPECIFICATION: Total Harmonic Distortion to 10 kHz: Greater than 50 dB below fundamental
Spurious Signals to 10 kHz: Greater than 50 dB below fundamental
Background Noise to 10 kHz: Less than –90 dBm

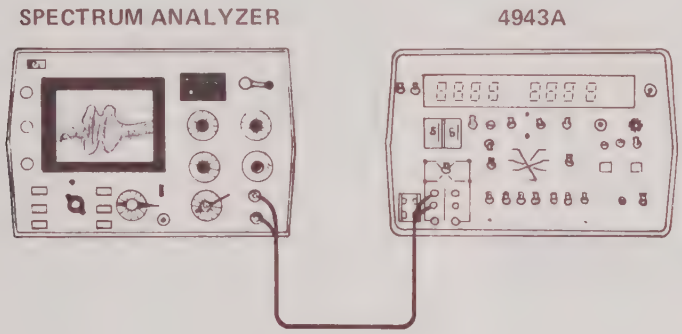

Figure 4-3. Harmonic Distortion, Spurious Signals, and Background Noise Test Setup

TEST EQUIPMENT REQUIRED: Spectrum Analyzer.

SETUP CONDITIONS: 4943A

MEASUREMENT	ENVELOPE DELAY
DISPLAY TRMT/RCV	TRMT
DISPLAY DELAY/LEVEL	LEVEL
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Spectrum Analyzer

Input	600 ohm terminated

PROCEDURE:

1. Set TRANSMITTER FREQUENCY to 1004 Hz and TRANSMITTER OUTPUT LEVEL to –30 dBm.
2. Set spectrum analyzer to sweep the frequency range from 0-10 kHz. The fundamental at 1004 Hz will be accompanied by 83 Hz sidebands (at 921 Hz and 1087 Hz), which will be 12 dB down. The signals at 83 Hz and 3095 Hz should be 52 dB below the fundamental level. All other harmonics and spurious signals must be at least 46 dB below the fundamental. Particular frequencies to measure are 166 Hz, 2008 Hz, 3012 Hz, and 5020 Hz.
3. Set MEASUREMENT switch to LEVEL & FREQUENCY. The 83 Hz sidebands will disappear. All harmonics and spurious signals must be at least 50 dB below the fundamental.
4. Background noise must be less than –90 dBm.

PERFORMANCE TESTS

4-12. PHASE JITTER ACCURACY TEST

SPECIFICATION:
Range: 0.2 to 30 degrees
Resolution: 0.1 degree
Accuracy: ±5% of reading
±0.2 degrees
Detector: Peak-to-Peak
Bandwidth (3 dB points):
Nominal 20 Hz to 300 Hz

NOTE

It is important to use an Audio Oscillator with 600 ohm output impedance in this test. Phase Jitter accuracy is determined by the combined output impedance accuracy of the 4943A under test and the external Audio Oscillator. Do not use an AC Calibrator (such as HP 745A) for this test, as it has a very low output impedance.

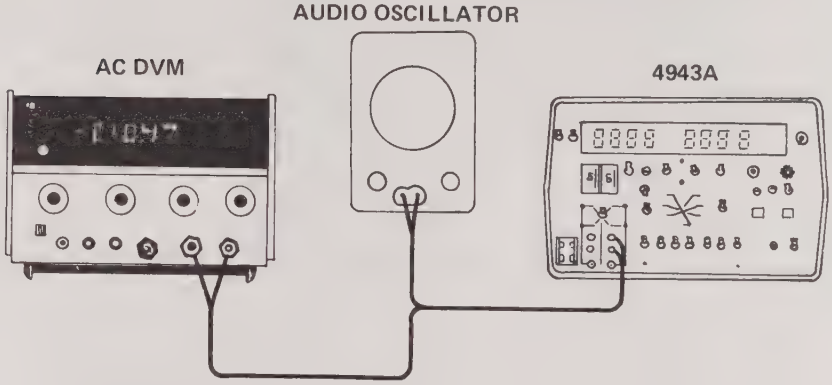

Figure 4-4. Phase Jitter Accuracy Test Setup

TEST EQUIPMENT REQUIRED: Audio Oscillator, AC DVM.

SETUP CONDITIONS: 4943A

MEASUREMENT ..... PHASE JITTER
DISPLAY TRMT/RCV ..... RCV
SETUP CONTROLS ..... UP
TRMT/RCV JACKS ..... Left jack field TRMT
Right jack field RCV

Audio Oscillator
Frequency ..... 1104 Hz
Amplitude ..... −20.0 dBm

PROCEDURE:

1. Adjust Audio Oscillator frequency to 1104 Hz. Adjust Audio Oscillator amplitude for AC DVM reading of 77.46 ±0.1 mVac.
2. Temporarily disconnect Audio Oscillator. Loop TRMT/RCV jacks. Adjust 4943A OUTPUT LEVEL for AC DVM reading of 774.6 ±1 mVac.
3. Reconnect Audio Oscillator (in parallel with TRMT/RCV loop). Left display must read 11.5 ±0.8 DEGREES.
4. Disconnect everything from RCV jacks. Left display must read ≤0.2 DEGREES.

PERFORMANCE TESTS

4-13. ACTIVE HOLD TEST

PERFORMANCE CHARACTERISTIC: 23 mA with external 48 Vdc source

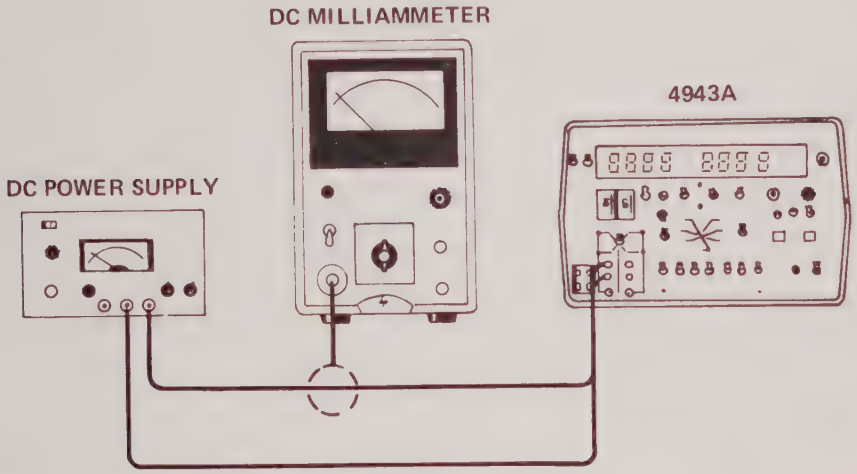

Figure 4-5. Active Hold Test Setup

TEST EQUIPMENT REQUIRED: DC Power Supply, DC Milliammeter.

SETUP CONDITIONS: 4943A

MEASUREMENT	LEVEL & FREQUENCY
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT
	Right jack field RCV

PROCEDURE:

1. Adjust DC Power Supply to 48 Vdc. Check for DC Milliammeter reading of 0 mA.
2. Select TEST WITH HOLD. DC Milliammeter must read 23 ±1 mA.
3. Disconnect DC Power Supply from left jack field and reconnect to right jack field.
4. DC Milliammeter must read 23±1 mA.

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Table 4-1. Performance Test Record (1 of 2)

Hewlett-Packard Model 4943A

Transmission Impairment Measuring Set

Serial No. A-

4943A Passes Self Check ☐

Tested by _____

Repair Order No. _____

Date _____

Recommended 6 Month Interval

PARAGRAPH NUMBER	TEST	RESULTS		
		MINIMUM	ACTUAL	MAXIMUM
4-9	FREQUENCY RANGE TEST			
	204 Hz Test	203.5 Hz	_____	204.5 Hz
	3904 Hz Test	3903.5 Hz	_____	3904.5 Hz
	Minimum Frequency	198 Hz	_____	200 Hz
	SF Skip Start	2449 Hz	_____	2451 Hz
	SF Skip Stop	2749 Hz	_____	2751 Hz
	Maximum Frequency	3949 Hz	_____	3951 Hz
4-10	OUTPUT LEVEL ACCURACY TEST			
	Displayed Transmitter Output Level at 1004 Hz and 774.6 mVac	− 0.1 dBm	_____	+ 0.1 dBm
	Displayed Receiver Level (dBm) at AC Calibrator Output (mVac)			
	774.6 mVac	− 0.1 dBm	_____	+ 0.1 dBm
	690.4 mVac	− 1.1 dBm	_____	− 0.9 dBm
	615.3 mVac	− 2.1 dBm	_____	− 1.9 dBm
	548.4 mVac	− 3.1 dBm	_____	− 2.9 dBm
	488.7 mVac	− 4.1 dBm	_____	− 3.9 dBm
	435.6 mVac	− 5.1 dBm	_____	− 4.9 dBm
	388.2 mVac	− 6.1 dBm	_____	− 5.9 dBm
	346.0 mVac	− 7.1 dBm	_____	− 6.9 dBm
	308.4 mVac	− 8.1 dBm	_____	− 7.9 dBm
	274.8 mVac	− 9.1 dBm	_____	− 8.9 dBm
	244.9 mVac	−10.1 dBm	_____	− 9.9 dBm
	218.3 mVac	−11.1 dBm	_____	−10.9 dBm
	194.6 mVac	−12.1 dBm	_____	−11.9 dBm
	173.4 mVac	−13.1 dBm	_____	−12.9 dBm
	154.6 mVac	−14.1 dBm	_____	−13.9 dBm
	137.7 mVac	−15.1 dBm	_____	−14.9 dBm
	122.8 mVac	−16.1 dBm	_____	−15.9 dBm
	109.4 mVac	−17.1 dBm	_____	−16.9 dBm
	97.52 mVac	−18.1 dBm	_____	−17.9 dBm
	86.91 mVac	−19.1 dBm	_____	−18.9 dBm
	77.46 mVac	−20.1 dBm	_____	−19.9 dBm
	43.56 mVac	−25.2 dBm	_____	−24.8 dBm
	24.49 mVac	−30.2 dBm	_____	−29.8 dBm
	13.77 mVac	−35.2 dBm	_____	−34.8 dBm

Table 4-1. Performance Test Record (2 of 2)

PARAGRAPH NUMBER	TEST	RESULTS		
		MINIMUM	ACTUAL	MAXIMUM
4-10 (Continued)	1.377 Vac	+ 4.8 dBm	_____	+ 5.2 dBm
	2.449 Vac	+ 9.8 dBm	_____	+10.2 dBm
4-11	HARMONIC DISTORTION, SPURIOUS SIGNALS, AND BACKGROUND NOISE TEST			
	With Envelope Delay Transmit, 1004 Hz carrier and −30 dBm output:			
	83 Hz sidebands at 921 Hz and 1087 Hz are 12 dB down, or more, from 1004 Hz level	12 dB	_____	X
	Signals below the 1004 Hz level at:			
	83 Hz	52 dB	_____	X
	166 Hz	46 dB	_____	X
	2008 Hz	46 dB	_____	X
	3012 Hz	46 dB	_____	X
	3095 Hz	52 dB	_____	X
	5020 Hz	46 dB	_____	X
	With Level and Frequency Transmit, 1004 Hz:			
	All harmonics and spurious signals at least 50 dB below 1004 Hz level	50 dB	_____	X
	Background noise less than −90 dBm	X	_____	−90 dBm
4-12	PHASE JITTER TEST			
	Phase Jitter Accuracy	10.7°	_____	12.3°
	Residual Phase Jitter	X	_____	0.2°
4-13	ACTIVE HOLD TEST			
	Left Jack, Active Hold Off	X	_____	0 mA
	Left Jack, Active Hold On	22 mA	_____	24 mA
	Right Jack, Active Hold Off	X	_____	0 mA
	Right Jack, Active Hold On	22 mA	_____	24 mA

Note: "X" denotes meaningless data results.

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section contains complete field adjustment information for the 4943A Transmission Impairment Measuring Set. The adjustments provide a means for calibrating the instrument to published specifications as presented in Table 1-1. Included in this section are equipment setups and procedures. The adjustments are presented in the recommended order for a complete instrument calibration.

5-3. SAFETY CONSIDERATIONS

5-4. The following precautions should be taken to insure against service person injury and instrument damage:

a. Remove ac power from the instrument when removing/installing instrument covers, when removing/installing PC boards, and when hooking up test equipment or test fixtures.

b. Use a properly grounded 3-wire receptacle for the instrument's power cord

WARNING

The adjustments described in this section are performed with power supplied to the instrument, and protective covers removed. These adjustments should be performed only by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock).

Voltages at ac line potential are present at several points. Use extreme caution when making waveform and voltage measurements.

c. Read the adjustment procedure completely before performing it.

5-5. EQUIPMENT REQUIRED

5-6. Equipment required for the adjustments is listed in the Recommended Test Equipment table in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted.

5-7. RELATED ADJUSTMENTS

5-8. It is seldom necessary to perform a complete adjustment procedure, except for possibly an annual calibration. However, it is necessary to perform certain adjustments after a PC board assembly is replaced (refer to Table 5-1), or when a component level repair is performed. A good check of an instrument's repair and/or adjustment is the self-check procedures as described in the Operation Section. Better yet is the performance tests as described in the Performance Tests Section.

5-9. ADJUSTMENT LOCATIONS

5-10. Adjustment locations are shown in Figure 5-18. This figure shows the location of all adjustments in the standard instrument. Figure 5-19 shows adjustment locations for the instrument with option 012 (NLD).

5-11. CALIBRATION CYCLE

5-12. An annual calibration is suggested for best performance of the 4943A. An abbreviated calibration may be performed at six months, between the annual calibrations. This abbreviated calibration will maintain the instrument in top working order:

a. TRMT/RCV System Gain Adjustment, paragraph 5-16.

b. Detectors, Log Quantizer, C-Message Filter, and TRMT Output Adjustment, paragraph 5-18.

5-13. OPTION 012 INSTRUMENT

5-14. This instrument deletes the phase jitter measurement capability and replaces it with the nonlinear distortion measurement. So do not perform the phase jitter adjustment of paragraph 5-24. Instead, paragraphs 5-30 and 5-31 provide for adjusting the NLD transmitter and receiver boards.

Table 5-1. Related Adjustments

ASSEMBLY CHANGED OR REPAIRED	PERFORM THE FOLLOWING RELATED ADJUSTMENTS	PARAGRAPH NUMBER
A7 NLD Receiver	Nonlinear Distortion Receiver Adjustment (Opt 012)	5-31
A8 Modem	Modem 800/1200 Hz Adjustment	5-28
A9 Filter Modulator	TRMT/RCV System Gain Adjustment	5-16
	Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-18
	Transmitter Spurious Signal Rejection Adjustment	5-21
A11 Output	TRMT/RCV System Gain Adjustment	5-16
	Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-18
A12 Front Panel Decoder	Active Hold Adjustment	5-25
A13 TRMT & LATCH	VCO Linearity Adjustment	5-19
A14 Envelope Delay	Envelope Delay Adjustment	5-22
A16 Holding Coil & Weighting Filter	TRMT/RCV System Gain Adjustment	5-16
	Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-18
	Active Hold Adjustment	5-25
A17 Notch Filter & Program Amp.	TRMT/RCV System Gain Adjustment	5-16
	Detectors, Log Quantizer, C-MSG Filter and TRMT Output Adjustment	5-18
	Noise-with-Tone Notch Filter Adjustment	5-27
A18 Detectors & Log Quantizer	TRMT/RCV System Gain Adjustment	5-16
	Slew Amplifier Zero Adjustment	5-17
	Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-18
	Impulse Noise Threshold Adjustment	5-23
A19 Freq. Tr. Loop	Pulse Width Matching Adjustment	5-20
A22 Phase Jitter	Phase Jitter Adjustment	5-24
A22 NLD Transmitter	Nonlinear Distortion Transmitter Adjustment (Opt 012)	5-30
A23 PWR SUP	Power Supply Adjustment	5-15

NOTE: An abbreviated calibration may be performed at six months, between the annual calibrations, as follows:

1. TRMT/RCV System Gain Adjustment, paragraph 5-16.
2. Detectors, Log Quantizer, C-MSG, and TRMT Output Adjustment, paragraph 5-18.

ADJUSTMENTS

5-15. POWER SUPPLY ADJUSTMENT (1 OF 2)

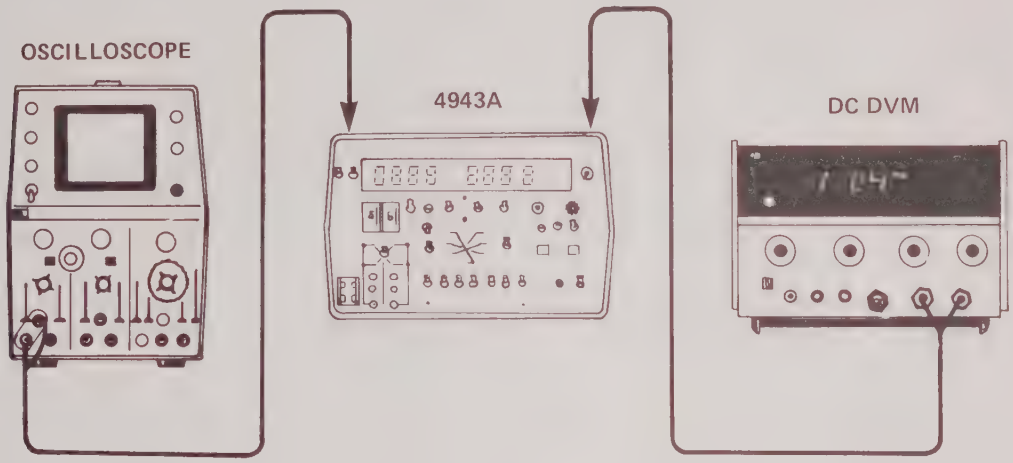

Figure 5-1. Power Supply Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Oscilloscope, DC DVM, variable ac transformer, extender board.

PC BOARD AFFECTED: A23.

SETUP CONDITIONS: Remove A16 Assembly and reinstall on extender board.
Connect ac power cord through variable ac transformer to power source.

PROCEDURE:

1. Apply ac power to instrument and adjust ac line voltage to 117 Vac.
2. Connect DC DVM and oscilloscope (in parallel) to XA16-22 (HI) and chassis (LO).
3. Adjust A23R27 for DC DVM reading of +5.00 ±0.01 Vdc. Adjust variable ac transformer for ac line voltage of 105 Vac, then adjust to 129 Vac. The +5V supply should remain constant ±0.02 Vdc. Return ac line voltage to 117 Vac.
4. Using oscilloscope, measure the ac ripple content of the +5V supply. The ac ripple should not exceed 5 mV p-p.
5. Connect DC DVM and oscilloscope (in parallel) to XA16-20 (HI) and chassis (LO).
6. Adjust A23R37 for DC DVM reading of +15.00 ±0.01 Vdc. Adjust variable ac transformer for ac line voltage of 105 Vac, then adjust to 129 Vac. The +15V supply should remain constant ±0.05 Vdc. Return ac line voltage to 117 Vac.

(continued next page)

ADJUSTMENTS

5-15. POWER SUPPLY ADJUSTMENT (2 OF 2)

7. Using oscilloscope, measure the ac ripple content of the +15V supply. The ac ripple should not exceed 10 mV p-p.
8. Connect DC DVM and oscilloscope (in parallel) to XA16-18 (HI) and chassis (LO).
9. Adjust A23R44 for DC DVM reading of −15.00 ±0.01 Vdc. Adjust variable ac transformer for ac line voltage of 105 Vac, then adjust to 129 Vac. The −15V supply should remain constant ±0.05 Vdc. Return ac line voltage to 117 Vac.
10. Using oscilloscope, measure the ac ripple content of the −15V supply. The ac ripple should not exceed 10 mV p-p.

ADJUSTMENTS

5-16. TRMT/RCV SYSTEM GAIN ADJUSTMENT

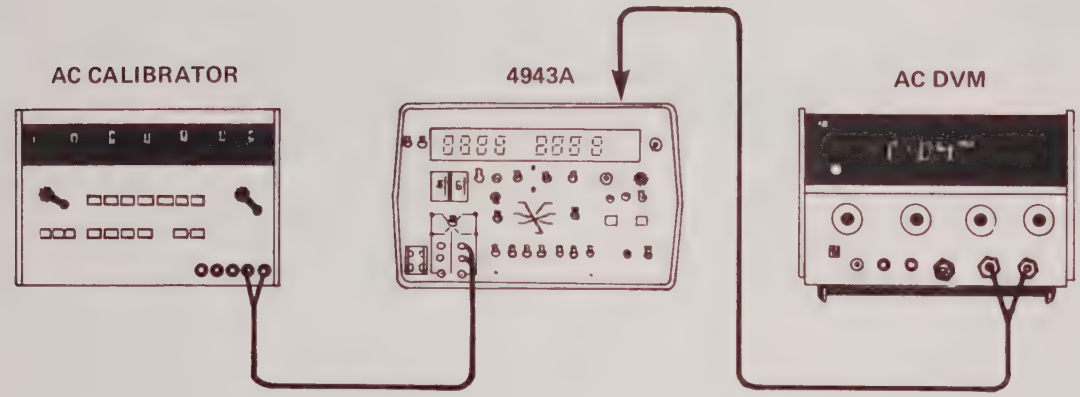

Figure 5-2. TRMT/RCV System Gain Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator, AC DVM.

PC BOARD AFFECTED: A17.

SETUP CONDITIONS: 4943A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT
	Right jack field RCV

AC Calibrator

Frequency	1004 Hz
Amplitude	774.6 mVac

PROCEDURE:

1. Connect AC DVM to A17TP4 (HI) and chassis (LO).
2. Adjust A17R55 for AC DVM reading of 1.845 ±0.001 Vac. This adjustment sets overall receiver gain.

ADJUSTMENTS

5-17. SLEW AMPLIFIER ZERO ADJUSTMENT

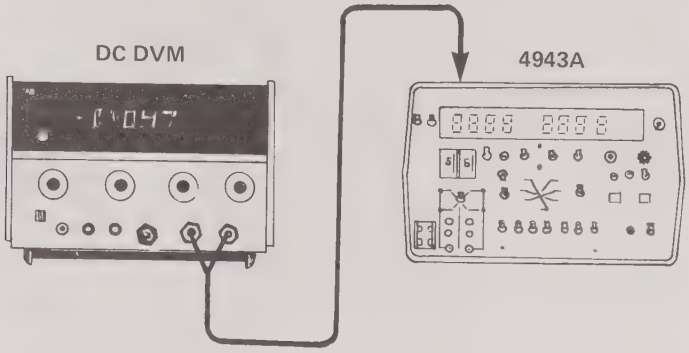

Figure 5-3. Slew Amplifier Zero Adjustment Test Setup

TEST EQUIPMENT REQUIRED: DC DVM, clip lead.

PC BOARD AFFECTED: A18.

SETUP CONDITIONS: 4943A

MEASUREMENT	IMPULSE NOISE
IMPULSE NOISE THRESHOLD DBRN	100 DBRN
NOISE FILTER	C-MSG
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Connect clip lead between A18TP1 and A18TP6.

PROCEDURE:

1. Connect DC DVM to A18TP1 (HI) and chassis (LO).
2. Adjust A18R35 for 0.000 ±0.003 Vdc.
3. Remove clip lead between A18TP1 and A18TP6.

ADJUSTMENTS

5-18. DETECTORS, LOG QUANTIZER, C-MESSAGE FILTER, AND TRMT OUTPUT ADJUSTMENT (1 OF 2)

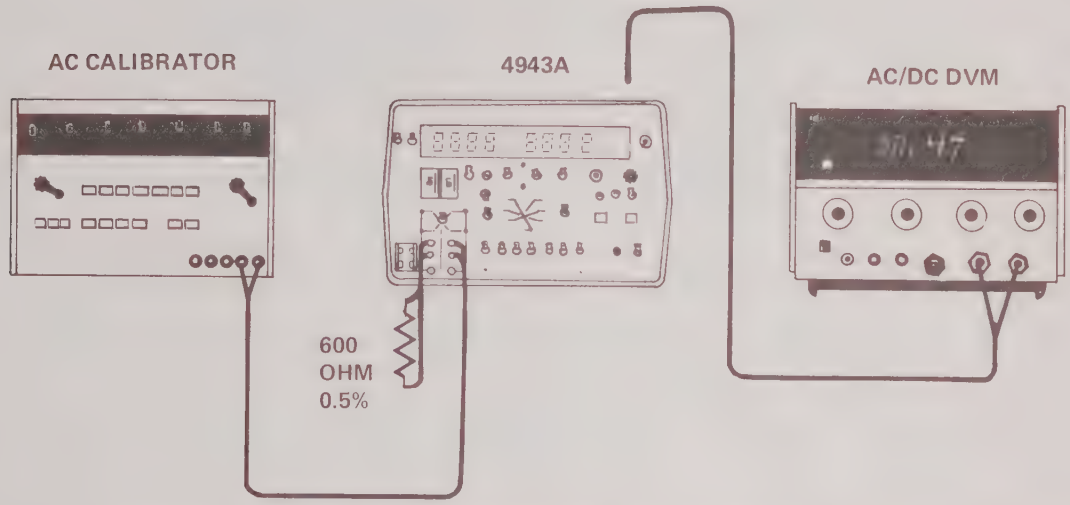

Figure 5-4. Detectors, Log Quantizer, C-Message Filter, and TRMT Output Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator, AC/DC DVM, 600 ohm resistor.

PC BOARDS AFFECTED: A9, A11, A16, A18

SETUP CONDITIONS: 4943A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
NOISE FILTER	C-MSG
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	1000 Hz
Amplitude	774.6 mVac

PROCEDURE:

1. Connect DC DVM to A18TP3 (HI) and chassis (LO).
2. Adjust A18R41 for DC DVM reading of +3.325 ±0.001 Vdc.
3. Disconnect DC DVM. Switch to SELF-CHECK. Depress and hold LEVEL ZERO switch until display shows dashed lines, then release. This allows the microprocessor and display circuitry to measure log quantizer pulse width.
4. Adjust AC Calibrator amplitude to 244.9 mVac. Adjust A18R21 for a display of 0 μS on the left display (set to the point where display oscillates between 0 and 1 μS).

(continued next page)

ADJUSTMENTS

5-18. DETECTORS, LOG QUANTIZER, C-MESSAGE FILTER, AND TRMT OUTPUT ADJUSTMENT (2 OF 2)

5. Adjust AC Calibrator amplitude back to 774.6 mVac. Adjust A18R59 for a display of 1000 μS on the left display.
6. These two adjustments interact somewhat. Repeat steps 4 and 5. These adjustments set the exact width of a 10 dB "window".
7. Set MEASUREMENT switch to NOISE-WITH-TONE. Adjust A18R11 for a display of 1000 μS on the left display.
8. Set MEASUREMENT switch to MESSAGE CKT NOISE. Adjust A16R11 for a display of 1000 μS on the left display.
9. Set AC Calibrator frequency to 3000 Hz. Adjust A16R50 for a display of 750 μS on the left display (corresponding to –2.5 dB at 3000 Hz).
10. These two adjustments interact somewhat. Repeat steps 8 and 9. These adjustments set the response curve of the C-Message Filter.
11. Set NOISE FILTER switch to 3 KHZ FLAT. Verify left display reading of 700 ±50 μS. Set NOISE FILTER switch back to C-MSG.
12. Set AC Calibrator frequency to 500 Hz. Verify left display reading of 250 ±50 μS at 500 Hz.
13. Set MEASUREMENT switch to LEVEL & FREQUENCY. Connect AC DVM to TRMT jacks (in parallel with 600 ohm resistor).
14. Adjust A9R9 for AC DVM reading of 774.6 ±0.3 mVac.
15. Disconnect AC Calibrator, AC DVM, and 600 ohm resistor. Loop TRMT/RCV jacks. Left display should read 1000 μS.
16. Select DISPLAY TRMT. Adjust A11R38 for left display reading obtained in step 15. This adjustment matches the transmitter display to the receiver.
17. Set NORMAL TEST/SELF-CHECK switch to NORMAL TEST.

ADJUSTMENTS

5-19. VCO LINEARITY ADJUSTMENT

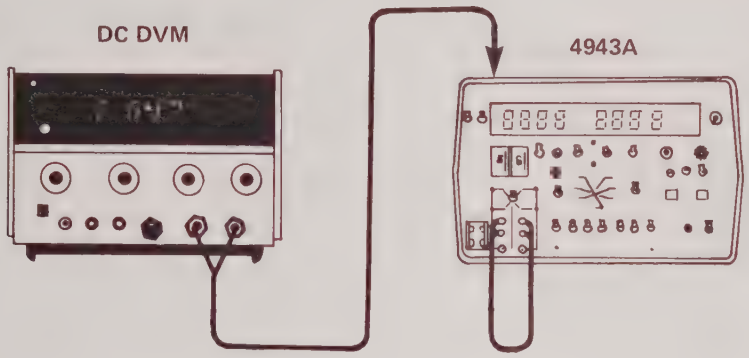

Figure 5-5. VCO Linearity Adjustment Test Setup

TEST EQUIPMENT REQUIRED: DC DVM, extender board.

PC BOARD AFFECTED: A13.

SETUP CONDITIONS: 4943A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT
	Right jack field RCV

Loop TRMT/RCV jacks. Adjust 4943A FREQUENCY to 204 Hz and OUTPUT LEVEL to +0.0 dBm.

Remove A13 Assembly and reinstall on extender board.

PROCEDURE:

1. Connect DC DVM to A13TP3 (HI) and chassis (LO).
2. Note DC DVM reading. Adjust 4943A FREQUENCY to 3904 Hz.
3. Adjust A13R49 for same DC DVM reading as that obtained in step 2.

ADJUSTMENTS

5-20. PULSE WIDTH MATCHING ADJUSTMENT

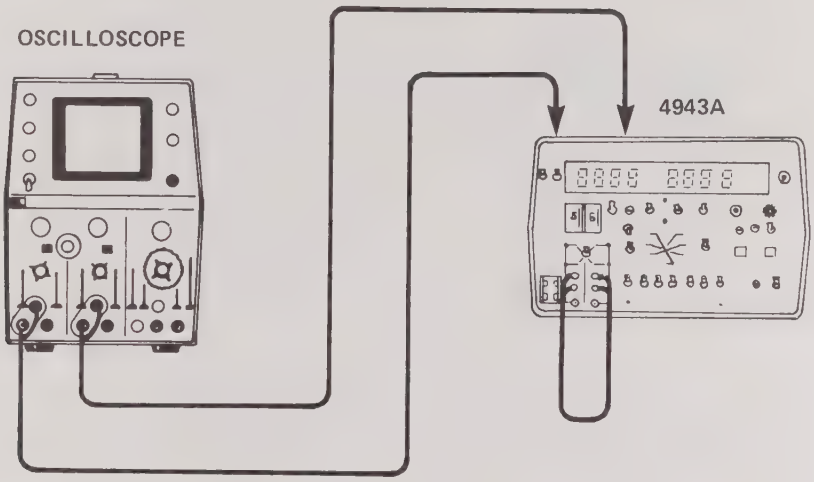

Figure 5-6. Pulse Width Matching Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Oscilloscope, extender board.

PC BOARD AFFECTED: A19.

SETUP CONDITIONS: 4943A

MEASUREMENT ..... LEVEL & FREQUENCY
SETUP CONTROLS .....UP
TRMT/RCV JACKS..... Left jack field TRMT
Right jack field RCV

Oscilloscope
Vertical .....0.5V/cm.
Horizontal ..... 20 μS/div.
Mode .....Alternate

Loop TRMT/RCV jacks. Adjust 4943A FREQUENCY to 1004 Hz and OUTPUT LEVEL to 0.0 dBm.

Remove A19 Assembly and reinstall on extender board.

PROCEDURE:

1. Connect CHAN A to XA19-C (HI) and chassis (LO). Connect CHAN B to XA19-6 (HI) and chassis (LO).
2. Adjust A19R23 for equal pulse widths on oscilloscope.

ADJUSTMENTS

5-21. TRANSMITTER SPURIOUS SIGNAL REJECTION ADJUSTMENT (1 OF 2)

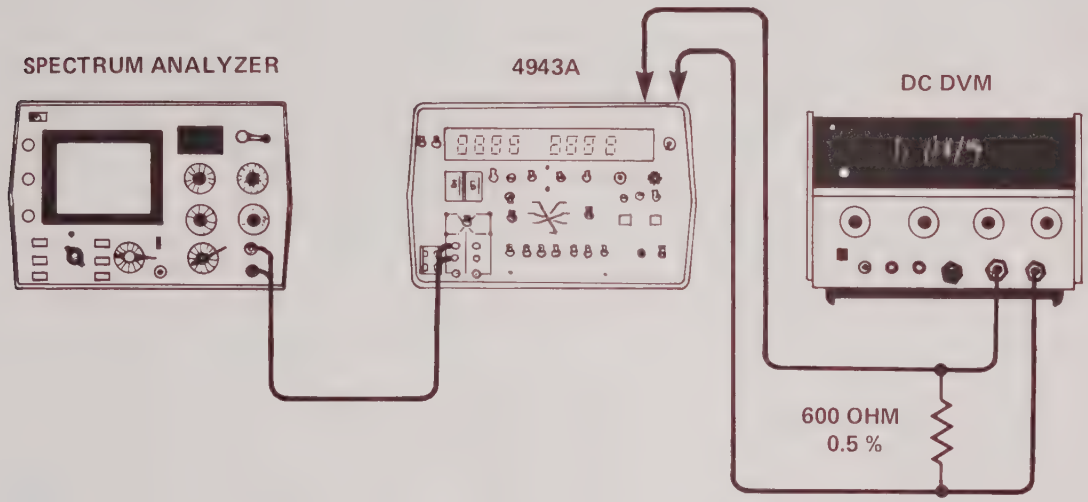

Figure 5-7. Transmitter Spurious Signal Rejection Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Spectrum Analyzer, DC DVM, 600 ohm resistor, extender board.

PC BOARD AFFECTED: A9.

SETUP CONDITIONS: 4943A

MEASUREMENT	LEVEL & FREQUENCY
SETUP CONTROLS	UP
DELAY NORMAL/REPEAT	NORMAL
DISPLAY TRMT/RCV	TRMT
DISPLAY DELAY/LEVEL	LEVEL
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Spectrum Analyzer

Input	600 ohm terminated
Frequency Span	20 kHz/div.

Remove A9 Assembly and reinstall on extender board.

Adjust 4943A FREQUENCY to 1004 Hz and OUTPUT LEVEL to –40.0 dBm.

(continued next page)

ADJUSTMENTS

5-21. TRANSMITTER SPURIOUS SIGNAL REJECTION ADJUSTMENT (2 OF 2)

PROCEDURE:

1. Connect DC DVM and 600 ohm resistor (in parallel) between XA9-E (HI) and chassis (LO).
2. Adjust A9R37 for 0.000 ±0.005 Vdc.
3. Disconnect DC DVM and 600 ohm resistor. Select ENVELOPE DELAY on MEASUREMENT switch.
4. Using the spectrum analyzer, search for the presence of a fundamental frequency 83 Hz tone (not 83 Hz sidebands).
5. Adjust A9R36 for minimum 83 Hz tone. Verify that all spurious signals are at least 50 dB below the fundamental tone.

ADJUSTMENTS

5-22. ENVELOPE DELAY ADJUSTMENT (1 OF 2)

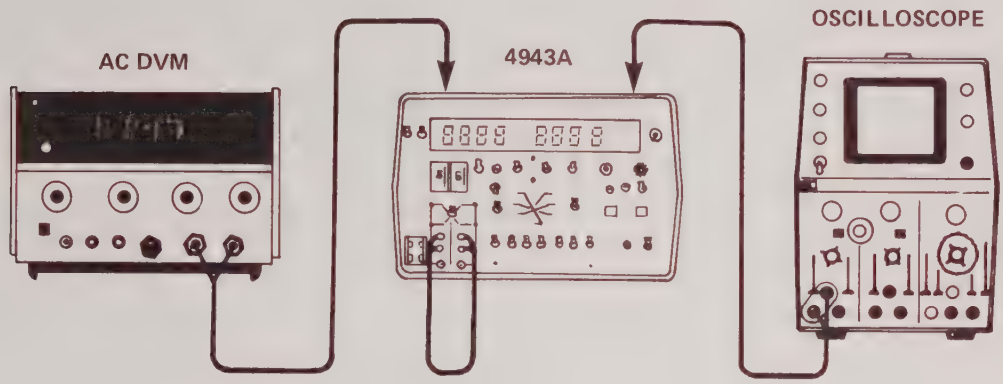

Figure 5-8. Envelope Delay Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC DVM, oscilloscope, extender board, clip lead.

PC BOARD AFFECTED: A14.

SETUP CONDITIONS: 4943A

MEASUREMENT	ENVELOPE DELAY
DISPLAY TRMT/RCV	TRMT
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Loop TRMT/RCV jacks. Remove A14 Assembly and reinstall on extender board.

PROCEDURE:

1. Disconnect A14JU2 from N1 pin and reconnect to T1 pin.
2. Disconnect A14JU4 from N3 and connect clip lead between A14JU4-3 and A14JU2-T1.
3. Disconnect A14JU3 from N2 pin and reconnect to T2 pin.
4. Depress front panel DELAY ZERO switch.
5. Move clip lead from A14JU2-T1 to A14TP6.
6. Adjust A14R78 for front panel display of either −3000 ±30 or +9000 ±30 MICRO SEC.
7. Remove clip lead and connect A14JU4 to N3 pin.
8. Adjust A14R86 for a front panel display of +6000 ±30 MICRO SEC.

(continued next page)

ADJUSTMENTS

5-22. ENVELOPE DELAY ADJUSTMENT (2 OF 2)

PROCEDURE:

9. Disconnect A14JU4 from N3 and connect clip lead between A14JU4-3 and A14TP10. The display should read +3000 ±150 MICRO SEC. This checks the LO-Q filter phase shift.
10. Remove clip lead and connect A14JU4 to N3.
11. Depress front panel DELAY ZERO switch.
12. Disconnect A14JU3 from T2 and reconnect to N2. The automatic filter correction loop works if the display reads 0 ±150 MICRO SEC and if A14TP7 measures within +2.5 and +5 VDC.
13. Depress DELAY ZERO. The display should read 0 MICRO SEC.
14. Disconnect A14JU2 from T1 and reconnect to N1.
15. Connect oscilloscope to A14TP6 (HI) and chassis (LO).
16. Adjust A14R20 for 3.9V p-p amplitude on oscilloscope.

ADJUSTMENTS

5-23. IMPULSE NOISE THRESHOLD ADJUSTMENT

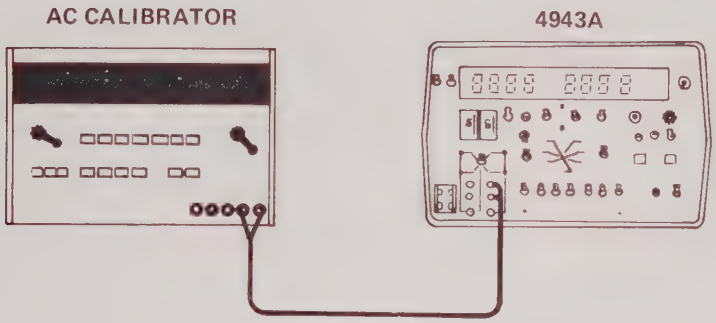

Figure 5-9. Impulse Noise Threshold Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator (or audio oscillator and AC DVM).

PC BOARD AFFECTED: A18.

SETUP CONDITIONS: 4943A

MEASUREMENT	IMPULSE NOISE
IMPULSE NOISE THRESHOLD DBRN	93 DBRN
NOISE FILTER	C-MSG
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	2000 Hz
Amplitude	774.6 mVac

PROCEDURE:

1. Disconnect input to RCV jacks.
2. Depress START RESET switch. Wait 10 seconds, then reconnect input to RCV jacks.
3. Adjust A18R42 to the point where the right display just begins to count.

ADJUSTMENTS

5-24. PHASE JITTER ADJUSTMENT (1 OF 2)

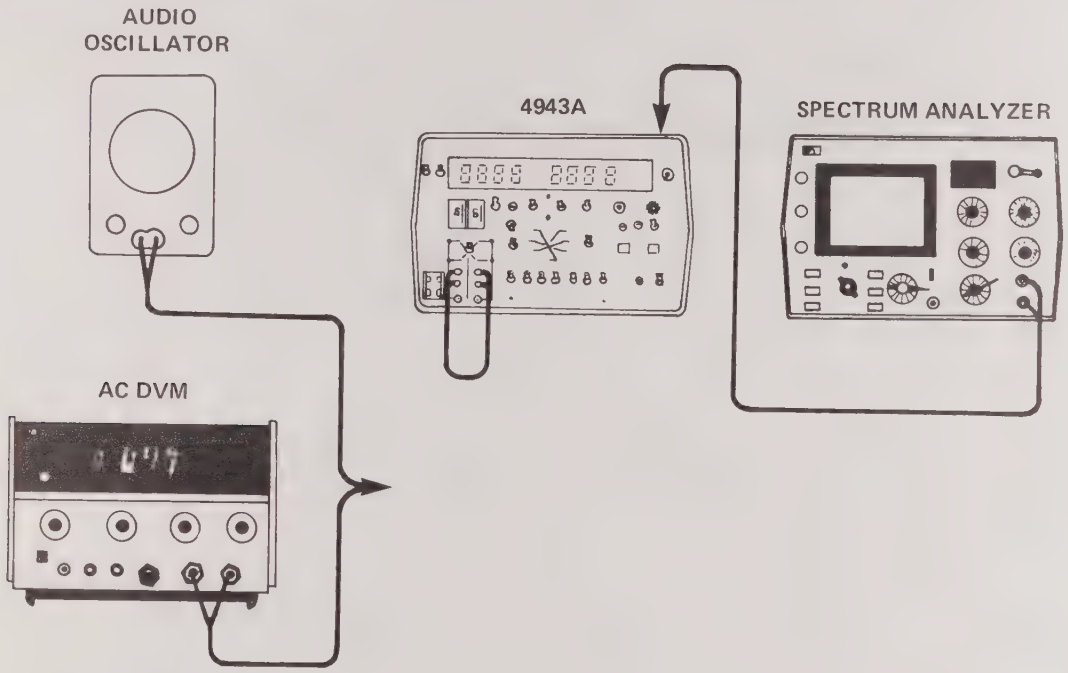

Figure 5-10. Phase Jitter Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Audio Oscillator, AC DVM, Spectrum Analyzer, extender board.

PC BOARD AFFECTED: A22.

SETUP CONDITIONS: 4943A

MEASUREMENT ..... PHASE JITTER
DISPLAY TRMT/RCV ..... RCV
DELAY NORMAL/REPEAT ..... NORMAL
SETUP CONTROLS ..... UP
TRMT/RCV JACKS ..... Left jack field TRMT
Right jack field RCV

Audio Oscillator

Frequency ..... 1104 Hz
Amplitude ..... −20.0 dBm

Loop TRMT/RCV jacks. Remove A22 Assembly and reinstall on extender board.

(continued next page)

ADJUSTMENTS

5-24. PHASE JITTER ADJUSTMENT (2 OF 2)

NOTE

It is important to use an Audio Oscillator with 600 ohm output impedance in this test. Phase Jitter accuracy is determined by the combined output impedance accuracy of the 4943A under test and the external Audio Oscillator. Do not use an AC Calibrator (such as HP 745A) for this test, as it has a very low output impedance.

PROCEDURE:

1. Connect Spectrum Analyzer between XA22-F (HI) and chassis (LO). Set Spectrum Analyzer to measure a 2008 Hz signal.
2. Adjust A22R28 for minimum 2008 Hz signal. The left display should read 0.2 DEGREES or less. Disconnect Spectrum Analyzer.
3. Temporarily disconnect loop between TRMT/RCV jacks. Connect Audio Oscillator to RCV jacks (in parallel with AC DVM). Adjust Audio Oscillator for frequency of 1104 Hz, and amplitude for AC DVM reading of 77.46 ±0.1 mVac.
4. Reconnect loop between TRMT/RCV jacks. Temporarily disconnect Audio Oscillator. Adjust 4943A OUTPUT LEVEL for AC DVM reading of 774.6 ±1 mVac.
5. Reconnect Audio Oscillator (in parallel with TRMT/RCV loop).
6. Adjust A22R64 for left display reading of 11.5 DEGREES. This sets phase jitter receiver response.
7. Disconnect Audio Oscillator and AC DVM. Switch to SELF-CHECK, then depress and hold LEVEL ZERO switch until display shows dashed lines, then release. This puts 4943A into the service mode. After 5 seconds, the left display should read 0.2 DEGREES or less.
8. Set DELAY NORMAL/REPEAT switch to REPEAT. Verify left display reading of 1.0 DEGREES or less. This check turns on the 83 Hz oscillator normally used in ENVELOPE DELAY to check phase jitter receive circuitry.
9. Set DELAY NORMAL/REPEAT switch to NORMAL. Set DISPLAY TRMT/RCV switch to TRMT. Adjust A22R52 for left display reading of 11.5 DEGREES. This sets the amplitude of the Self-Check Phase Jitter Test Oscillator.
10. Set NORMAL TEST/SELF-CHECK switch back to NORMAL TEST.

ADJUSTMENTS

5-25. ACTIVE HOLD ADJUSTMENT

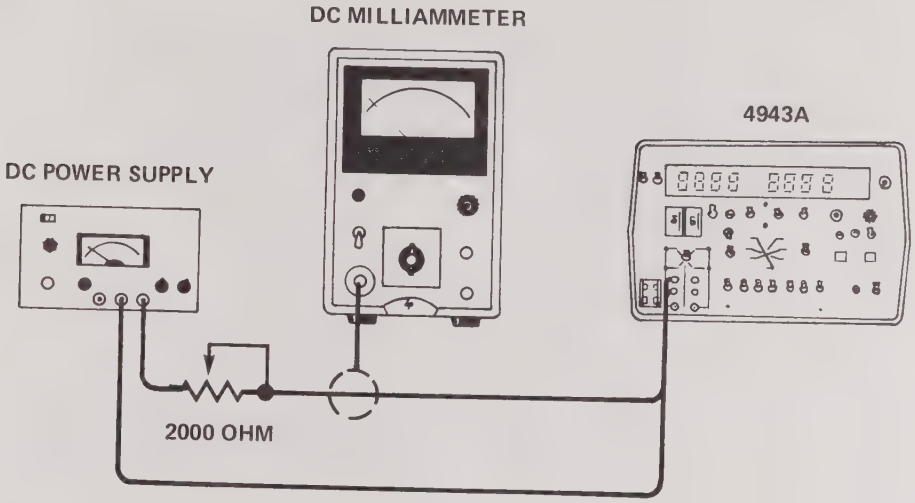

Figure 5-11. Active Hold Adjustment Test Setup

TEST EQUIPMENT REQUIRED: DC Power Supply, DC Milliammeter, 2000 ohm, 2W potentiometer.

PC BOARDS AFFECTED: A12, A16.

SETUP CONDITIONS: 4943A

MEASUREMENT ..... LEVEL & FREQUENCY
SETUP CONTROLS ..... UP, except select TEST WITH HOLD
TRMT/RCV JACKS ..... Left jack field TRMT
Right jack field RCV

PROCEDURE:

1. Set potentiometer to 1700 ohms. Adjust DC Power Supply to 46 Vdc.
2. Adjust A12R19 for 23 mA reading on DC Milliammeter.
3. Set potentiometer to 400 ohms. Adjust DC Power Supply to 53 Vdc. Verify that current is ≤ 40 mA.
4. Set potentiometer to 0 ohms. Adjust DC Power Supply to 7 Vdc. Verify that current is ≥ 23 mA.
5. Leaving potentiometer at 0 ohms, adjust DC Power Supply to 5 Vdc. Verify that current is < 5 mA.
6. Set potentiometer to 1700 ohms. Adjust DC Power Supply to 46 Vdc. Connect leads to Right jack field.
7. Adjust A16R41 for 23 mA reading on DC Milliammeter.
8. Repeat steps 3 through 5.

5-26. ANALOG OUTPUTS ADJUSTMENT

NO ADJUSTMENT NEEDED

ADJUSTMENTS

Note: This adjustment need not be made as a periodic calibration step. Perform only when necessary, such as after component repair on affected circuitry.

5-27. NOISE-WITH-TONE NOTCH FILTER ADJUSTMENT (1 OF 2)

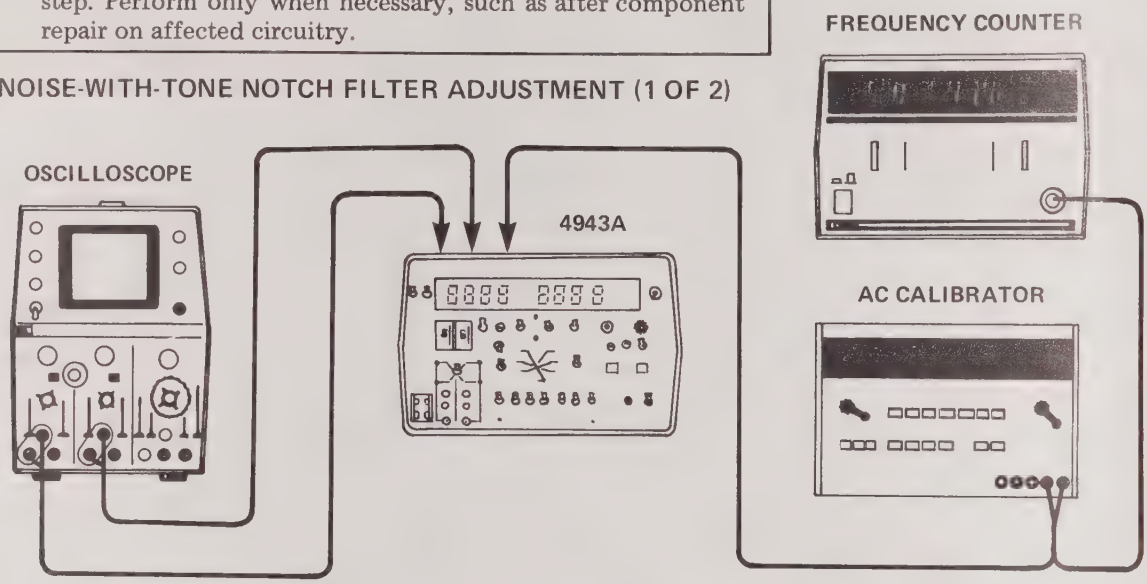

Figure 5-13. Noise-with-Tone Notch Filter Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator (or audio oscillator and AC DVM), oscilloscope, frequency counter, extender board.

PC BOARD AFFECTED: A17.

SETUP CONDITIONS: 4943A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	1010 Hz
Amplitude	244.9 mVac

Oscilloscope

Vertical — CHAN A	0.5V/cm	Note: Use 1:1 probes, or better yet, use straight-thru cables.
Vertical — CHAN B	0.5V/cm	
Mode	A vs. B	

Remove A17 Assembly and reinstall on extender board.

PROCEDURE:

1. Disconnect coax cable between A6 and A17 assemblies. Connect CHAN A to A17W1 (in parallel with AC Calibrator). Connect CHAN B to A17J1-7 (HI) and chassis (LO).

(continued next page)

ADJUSTMENTS

5-27. NOISE-WITH-TONE NOTCH FILTER ADJUSTMENT (2 OF 2)

PROCEDURE:

2. Adjust AC Calibrator frequency to 1010 Hz. Adjust oscilloscope for a lissajous pattern (depending on how close the adjustment is, this could be either a line from upper left to lower right, a circle, or something in between).
3. Adjust A17R4 for a straight line from upper left to lower right (corresponding to a 180° phase shift).
4. Connect CHAN B to A17J1-8 (HI) and chassis (LO). Adjust AC Calibrator frequency to 892 Hz. Adjust oscilloscope for a lissajous pattern.
5. Adjust A17R6 for a straight line from upper left to lower right (corresponding to a 180° phase shift).
6. Connect CHAN A to A17J1-6 (in parallel with AC Calibrator). Connect CHAN B to A17J1-5 (HI) and chassis (LO). Adjust AC Calibrator frequency to 1010 Hz. Adjust oscilloscope for a lissajous pattern.
7. Adjust A17R13 for a straight line from upper right to lower left (corresponding to a 0° phase shift).
8. Connect CHAN B to A17J1-2 (HI) and chassis (LO). Adjust AC Calibrator frequency to 840 Hz. Adjust oscilloscope for a lissajous pattern.
9. Adjust A17R15 for a straight line from upper right to lower left (corresponding to a 0° phase shift).
10. Connect CHAN A to A17J1-1 (in parallel with AC Calibrator). Connect CHAN B to A17J1-4 (HI) and chassis (LO). Adjust Calibrator frequency to 1010 Hz. Adjust oscilloscope for a lissajous pattern.
11. Adjust A17R22 for a straight line from upper right to lower left (corresponding to a 0° phase shift).
12. Connect CHAN B to A17J1-3 (HI) and chassis (LO). Adjust AC Calibrator frequency to 1260 Hz. Adjust oscilloscope for a lissajous pattern.
13. Adjust A17R24 for a straight line from upper left to lower right (corresponding to a 180° phase shift).

ADJUSTMENTS

> Note: This adjustment need not be made as a periodic calibration step. Perform only when necessary, such as after component repair on affected circuitry.

5-28. MODEM 800/1200 Hz ADJUSTMENT

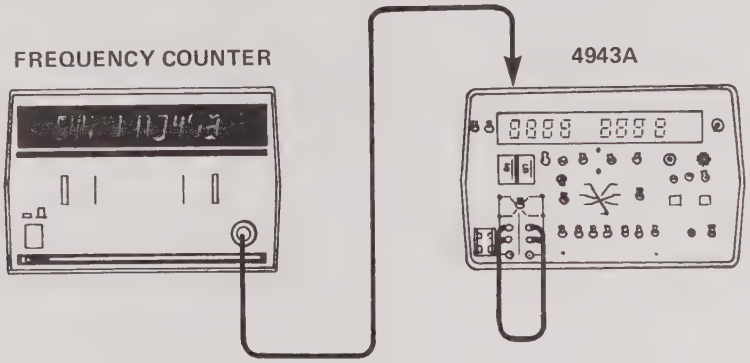

Figure 5-14. Modem 800/1200 Hz Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Frequency Counter, extender board, clip lead.

PC BOARD AFFECTED: A8.

SETUP CONDITIONS: 4943A

MEASUREMENT..... LEVEL & FREQUENCY
SETUP CONTROLS .....UP
TRMT/RCV JACKS..... Left jack field TRMT
Right jack field RCV

Loop TRMT/RCV jacks. Remove A8 Assembly and reinstall on extender board.

PROCEDURE:

1. Switch to SELF-CHECK. Depress and hold DELAY ZERO switch until left display indicates "PASS", then release.
2. Connect frequency counter to XA8-10 (HI) and chassis (LO). Connect clip lead between XA8-S and XA8-1.
3. Adjust A8R7 for frequency counter reading of 800 ±2 Hz.
4. Reconnect clip lead between XA8-S and XA8-22.
5. Adjust A8R9 for frequency counter reading of 1200 ±2 Hz.
6. Remove clip lead between XA8-S and XA8-22.

ADJUSTMENTS

> Note: This adjustment need not be made as a periodic calibration step. Perform only when necessary, such as after component repair on affected circuitry.

5-29. IMPULSE NOISE COUNT-RATE ADJUSTMENT

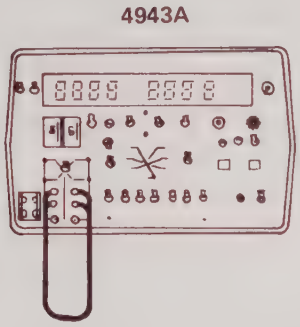

Figure 5-15. Impulse Noise Count-Rate Adjustment Test Setup

TEST EQUIPMENT REQUIRED: None.

PC BOARD AFFECTED: A18.

SETUP CONDITIONS: 4943A
SETUP CONTROLS. . . . . UP
Loop TRMT/RCV jacks.

PROCEDURE:

1. Start self check by moving NORMAL TEST/SELF CHECK switch to SELF CHECK.
2. Observe COUNTS accumulated in right display during the impulse noise test.
3. Adjust A18R61 to give 70 ±2 counts.

ADJUSTMENTS

5-30. NONLINEAR DISTORTION TRANSMITTER ADJUSTMENT – OPT 012

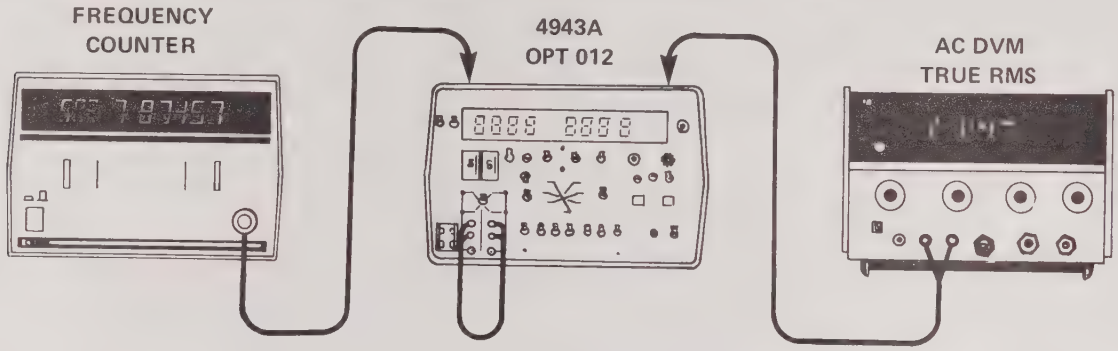

Figure 5-16. Nonlinear Distortion Transmitter Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Frequency counter, AC DVM, extender board.

PC BOARD AFFECTED: A22.

SETUP CONDITIONS: 4943A

MEASUREMENT	SIGNAL TO NOISE
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Loop TRMT/RCV jacks. Remove A22 Assembly and reinstall on extender board.

PROCEDURE:

1. Switch to SELF-CHECK, then immediately depress and hold LEVEL ZERO Switch until dashed lines appear on display.
2. Connect AC DVM to A22TP1 (HI) and chassis (LO). Verify AC DVM reading of 1094 ±60 mVac.
3. Set MEASUREMENT Switch to NONLINEAR DISTORTION. Verify right display reading of "PL-3", indicating both decoders are phase-locked. If reading is "PL-0", "PL-1" or "PL-2", repeat previous steps.
4. Connect AC DVM to A22U11 pin 1 (HI) and chassis (LO). Verify AC DVM reading of 774.6 ±45 mVac.
5. Connect AC DVM to A22U16 pin 1 (HI) and chassis (LO). Verify AC DVM reading of 774.6 ±45 mVac.
6. Connect frequency counter to A22TP5 (HI) and chassis (LO). Adjust A22R32 for frequency counter reading of 1388 ±2 Hz.
7. Connect frequency counter to A22TP6 (HI) and chassis (LO). Adjust A22R27 for frequency counter reading of 863 ±2 Hz.

ADJUSTMENTS

5-31. NONLINEAR DISTORTION RECEIVER ADJUSTMENT – OPT 012 (1 of 2)

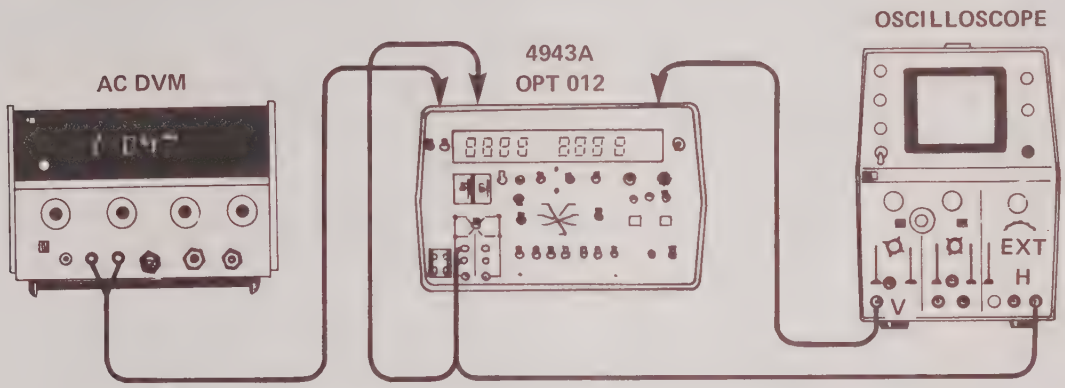

Figure 5-17. Nonlinear Distortion Receiver Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC DVM, oscilloscope, extender board.

PC BOARD AFFECTED: A7.

SETUP CONDITIONS: 4943A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	TRMT
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Remove A7 Assembly and reinstall on extender board.

PROCEDURE:

1. Loop TRMT/RCV jacks. Adjust 4943A TRANSMITTER to exactly 860 Hz. Connect AC DVM to XA7-M(HI) and chassis (LO). Adjust A7R1 for minimum signal.
2. Adjust 4943A TRANSMITTER to exactly 1380 Hz. Connect AC DVM to XA7-12 (HI) and chassis (LO). Adjust A7R2 for minimum signal.
3. Disconnect loop from TRMT/RCV jacks. Temporarily disconnect A7JU1. Connect front panel TRMT jacks to XA7-19 (Tip) and chassis (Ring). Connect oscilloscope EXT HORIZONTAL to TRMT jacks.
4. Connect oscilloscope VERTICAL to XA7-6 (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 498 Hz. Adjust oscilloscope for a lissajous pattern (depending on how close the adjustment is, this could be either a line from upper right to lower left, a circle, or something in between).

(continued next page)

ADJUSTMENTS

5-31. NONLINEAR DISTORTION RECEIVER ADJUSTMENT – OPT 012 (2 of 2)

5. Adjust A7R6 for a straight line from upper right to lower left (corresponding to a 0° phase shift).

6. Connect oscilloscope VERTICAL to XA7-9 (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 513 Hz. Adjust A7R7 for a straight line from upper right to lower left.

7. Connect oscilloscope VERTICAL to XA7-17 (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 523 Hz. Adjust A7R8 for a straight line from upper right to lower left.

8. Connect oscilloscope VERTICAL to XA7-L (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 2218 Hz. Adjust A7R10 for a straight from upper right to lower-left.

9. Connect oscilloscope VERTICAL to XA7-H (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 2236 Hz. Adjust A7R11 for a straight line from upper right to lower left.

10. Connect oscilloscope VERTICAL to XA7-E (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 2236 Hz. Adjust A7R11 for a straight line from upper right to lower left.

11. Connect oscilloscope VERTICAL to XA7-K (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 1873 Hz. Adjust A7R3 for a straight line from upper right to lower left.

12. Connect oscilloscope VERTICAL to XA7-J (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 1883 Hz. Adjust A7R4 for a straight line from upper right to lower left.

13. Connect oscilloscope VERTICAL to XA7-F (HI) and chassis (LO). Adjust 4943A TRANSMITTER to exactly 1903 Hz. Adjust A7R5 for a straight line from upper right to lower left.

14. Disconnect oscilloscope. Reconnect A7JU1. Loop TRMT/RCV jacks. Connect jumpers between XA7-7 and chassis and XA7-8 and chassis. Connect jumper between XA7-D and XA7-22.

15. Adjust 4943A TRANSMITTER to exactly 520 Hz. Connect AC DVM to XA7-S (HI) and chassis (LO). Adjust 4943A OUTPUT LEVEL for AC DVM reading of 774.6 ±1 mVac.

16. Connect AC DVM to output cable A7W1 (HI) and chassis (LO). Adjust A7R13 for AC DVM reading of 690.4 ±1 mVac.

17. Adjust 4943A TRANSMITTER to exactly 2240 Hz. Adjust A7R12 for AC DVM reading of 690.4 ±1 mVac.

18. Disconnect jumper between XA7-D and XA7-22. Reconnect jumper between XA7-D and chassis. Adjust 4943A TRANSMITTER to exactly 1900 Hz. Adjust A7R14 for AC DVM reading of 975.2 ±1 mVac.

19. Disconnect all jumpers from extender board.

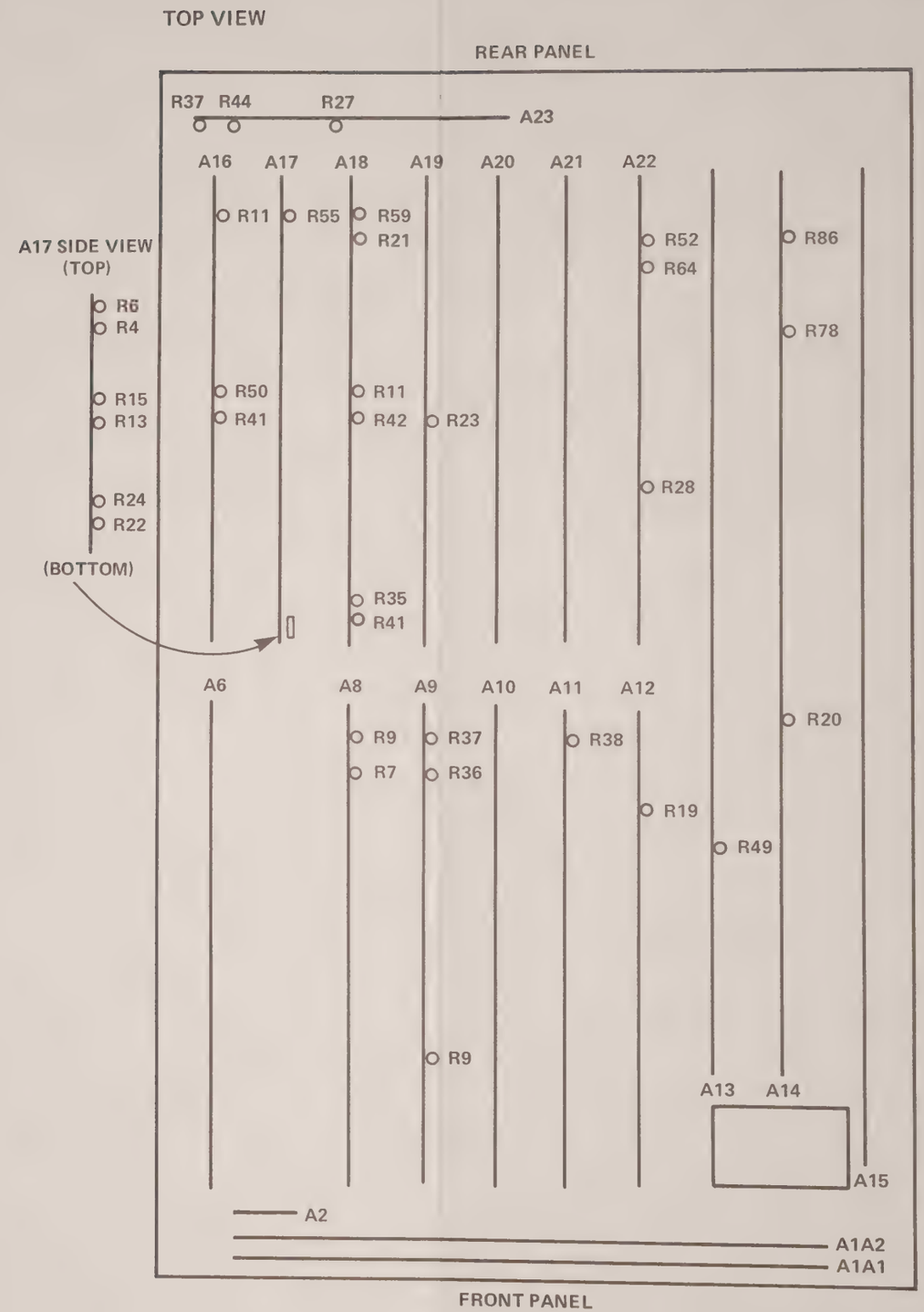

Figure 5-18. Adjustment Locations, Standard Instrument (with Phase Jitter)

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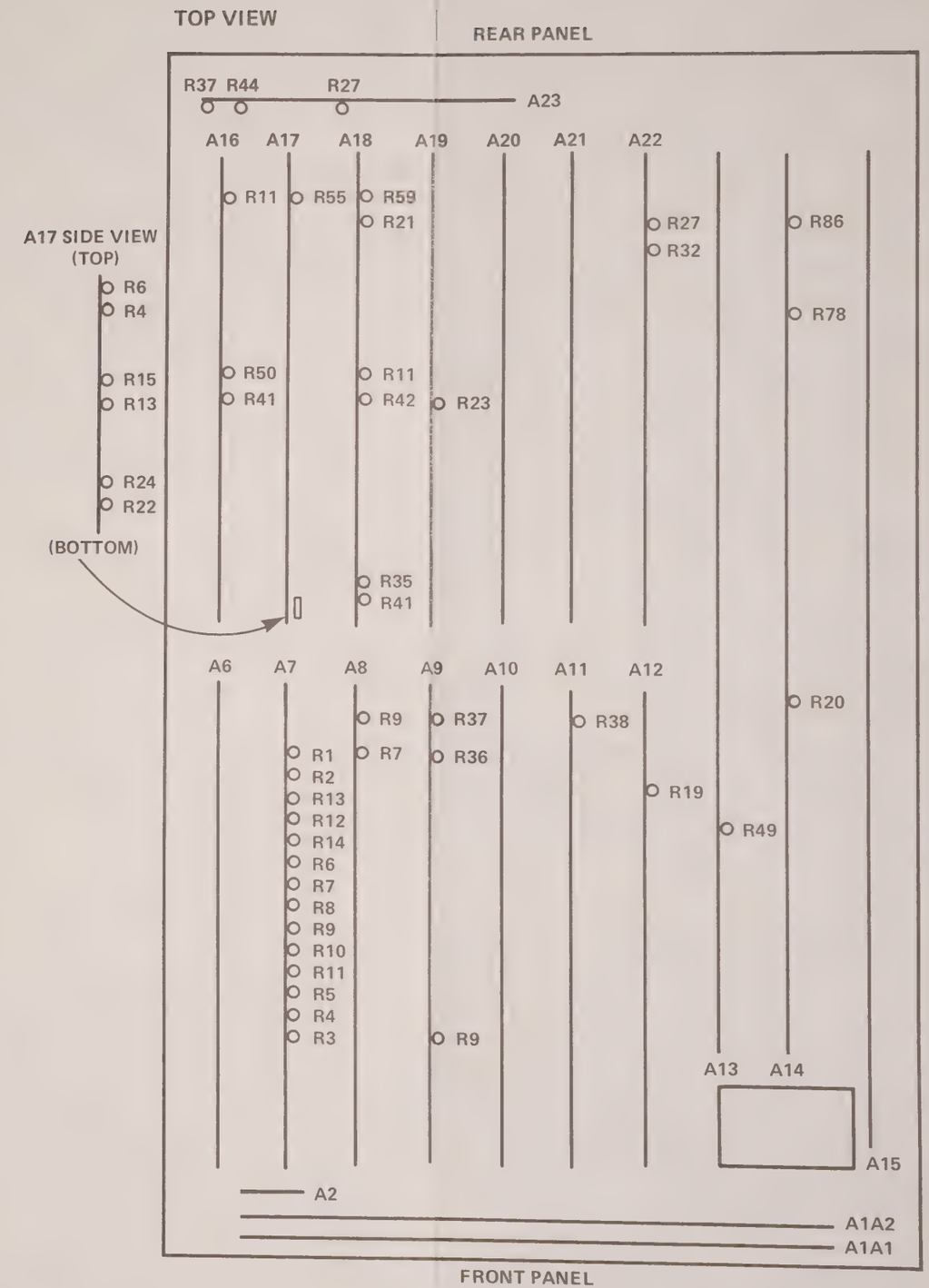

Figure 5-19. Adjustment Locations, Option 012 Instrument (with Nonlinear Distortion)

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SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 is a list of new assemblies, and Table 6-2 lists abbreviations used in the parts list. Table 6-3 lists all replaceable parts in reference designator order.

6-3. REPLACEABLE PARTS LIST

6-4. Table 6-3 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alphanumeric order by reference designation.

b. Chassis mounted electrical parts in alphanumeric order by reference designation.

c. Mechanical parts in reference designator order, along with a parts location drawing.

6-5. The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity used in the instrument.

c. The description of the part.

d. A typical manufacturer of the part as a five digit code.

e. The manufacturer's number for the part.

6-6. Table 6-4 contains a cross reference list between manufacturer's code and actual name and address.

Table 6-1. New Replaceable Assembly Part Numbers

REFERENCE DESIGNATOR	DESCRIPTION	NEW ASSY PART NO.
A1	Display PC Bd Assy	04943-60001
A2	Thumbwheel Switch PC Bd Assy	04942-60002
A3	Switch PC Bd Assy	04943-60124
A3	Switch PC Bd Assy (Opt 012)	04943-60128
A3	Switch PC Bd Assy (Opt 011)	04943-60503
A4	Not Used	
A5	Mother PC Bd Assy	04943-60125
A6	Input PC Bd Assy	04943-60126
A7	NLD Receiver (Opt 012)	04944-60007
A8	Modem PC Bd Assy	04942-60008
A9	Filter Modulator PC Bd Assy	04942-60009
A10	Transmit Control PC Bd Assy	04942-60010
A11	Output PC Bd Assy	04943-60011
A12	Front Panel Decoder PC Bd Assy	04943-60012
A13	Transmitter & Latch PC Bd Assy	04943-60013
A14	Envelope Delay PC Bd Assy	04942-60014
A15	Microprocessor PC Bd Assy	04943-60015
A16	Holding Coil & Weighting Filters PC Bd Assy	04943-60016
A17	Notch Filter & Programmable Amp PC Bd Assy	04943-60127
A18	Detectors & Log Quantizer PC Bd Assy	04943-60018
A19	Frequency Tracking Loop PC Bd Assy	04943-60019
A20	Analog Outputs PC Bd Assy	04943-60020
A21	HP-IB PC Bd Assy (Opt 010)	04942-60021
A22	Phase Jitter PC Bd Assy	04943-60022
A22	NLD Transmitter (Opt 012)	04944-60022
A23	Power Supply PC Bd Assy	04942-60023
A24	HP-IB Connector Assy (Opt 010)	04942-60024

Table 6-2. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A = assembly	JU = jumper	U = integrated circuit, non-repairable assembly
B = motor, synchro, fan	K = relay	V = vacuum tube, photocell, etc.
BP = binding post	L = inductor	VR = voltage regulator
BT = battery	M = meter	W = jumper wire, cable assembly
C = capacitor	OE = optical encoder	X = socket
CB = circuit breaker	P = plug connector	Y = crystal
CR = diode	Q = transistor	Z = tuned cavity, network
DL = delay line	R = resistor	
DS = indicator, display	RT = thermistor	
E = Misc electrical parts	S = switch	
F = fuse	T = transformer	
FL = filter	TB = terminal board	
J = receptacle connector, jack	TP = test point	

ABBREVIATIONS

A = amperes	DIA = diameter	K = kilo (10^3), kilohm
AC = alternating current	DIP = dual in-line package	
ADD = address	DPDT = double-pole, double-throw	LED = light emitting diode
ADJ = adjust, adjustment	DPST = double-pole, single-throw	LFT = left
AL = aluminum	DR = drive	LG = long
AR = as required	DRVR = driver	LH = left hand
ASM = algorithmic state machine	DSPL = display	LKWR = lockwasher
ASSY = assembly	DTL = diode-transistor logic	LP = low pass
		LS = low power Schottky
B = base	E = emitter	LSB = least significant bit
BCD = binary coded decimal	ECL = emitter-coupled logic	
BeCu = beryllium copper	ELECT = electrolytic	M = milli (10^{-3}), male, mega (10^6), megohm
BIN = binary	ENCAP = encapsulated	MET FLM = metal film
BLK = black	EXT = external	MET OX = metal oxide
BLU = blue	EXTR = extractor	MHZ = megahertz
BP = band pass		MFR = manufacturer
BRN = brown	F = female, farads	MINTR = miniature
BRS = brass	FF = flip-flop	MISC = miscellaneous
BTU = British thermal unit	FLM = film	MOM = momentary
	FRNT = front	MOS = metal oxide semiconductor
C = collector	FXD = fixed	MSB = most significant bit
CATH = cathode		MTCHD = matched
CCW = counterclockwise	G = giga (10^9)	MTG = mounting
CD PL = cadmium plate	GE = germanium	MTLC = metallic
CER = ceramic	GL = glass	
CERMET = ceramic met flm	GND = ground(ed)	N = nano (10^{-9})
CKTS = circuits	GP = General Purpose	N.C. = normally closed, no connection
C FLM = carbon film	GRA = gray	
CLK = clock	GRN = green	NE = neon
CLR = clear		NO. = number
CMOS = complementary metal oxide semiconductor logic	H = henries	N.O. = normally open
	HDW = hardware	NP = No Polarity
COM = common	HEX = hexagon, hexagonal, six	NPN = negative-positive-negative
COML = commercial	HP = high pass	NPO = negative-positive zero (zero temperature coefficient)
COMP = composition	HR = hour(s)	
COMPL = complete	HZ = Hertz	NRFR = not recommended for field replacement
COND = conductor		
CONN = connector	IC = integrated circuit	NS = normally shorting, nanosecond
CONT = contact	ID = inside diameter	
CPRSN = compression	IF = intermediate frequency	NSR = not separately replaceable
CTL = complementary-transistor logic	IN. = inch, inches	NYL = nylon
	INCAND = incandescent	
CW = clockwise	INCL = include(s)	OBD = order by description
	INSUL = insulation, insulated	OD = outside diameter
D = diameter	INT = internal	ORN = orange
DC = direct current	INTL = internal	
DEPC = deposited carbon		

Table 6-2. Reference Designations and Abbreviations (2 of 2)

ABBREVIATIONS

P = pico (10^{-12})	RVT = rivet	TRN = turn
PC = printed circuit	RWV = reverse working voltage	TTL = transistor-transistor logic
PCA = printed-circuit assembly		TYP = typical
PF = picofarad	S = second	
PIV = Peak Inverse Voltage	SB = slow blow	U (μ) = micro (10^{-6})
PK = peak	SCR = silicon controlled rectifier	UF = microfarad
PNL = panel	SE = selenium	US = microseconds
PNP = positive-negative-positive	SGL = single	
P-P = peak-to-peak	SI = silicon	V = volt(s)
PPM = parts per million	SHK = shank	VAR = variable
POLYC = polycarbonate	SIP = single in-line package	VCO = voltage controlled oscillator
POLYE = polyethylene	SKT = socket	VDCW = direct current working volts
POLYSTY = polystyrene	SLDR = solder	VIO = violet
PORC = porcelain	SPCG = spacing	VNP = no polarity voltage
POSN = position(s)	SPDT = single-pole, double-throw	
POZI = pozidrive	SPST = single-pole, single-throw	W = watts
PRV = peak reverse voltage	SST = stainless-steel	WT = weight
PWV = peak working voltage	STL = steel	WW = wirewound
P/O = part of	SZ = size	WHT = white
		WIP = wiper
R = ring	T = tip	WIV = working inverse voltage
RAM = random access memory	TA = tantalum	WSHR = washer
ROM = read only memory	TEL = telephone	
RECT = rectifier	T.C. = Temp. Compensated, temp. coefficient	X = times, multiple
RF = radio frequency		
RH = right hand	THKNS = thickness	YEL = yellow
RMS = root-mean-square	TI = titanium	
RND = round	TGL = toggle	ZNR = zener
RT = right hand	THD = thread	
RTL = resistor-transistor logic	THK = thick	ϕ = phi, phase
RTNT = retainer	TOL = tolerance	
RTRY = rotary	TRMR = trimmer	

Table 6-3. Replaceable Parts (1 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	04943-60001	1	DISPLAY PC BOARD ASSEMBLY	28480	04943-60001
A1A1			DISPLAY & ANNUNCIATOR (NBR, P/O A1)		
A1A1DS1	1990-0540	3	8 DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS2	1990-0540	3	DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS3	1990-0540	3	DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS4	1990-0540	3	DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS5	1990-0540	3	DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS6	1990-0540	3	DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS7	1990-0540	3	DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS8	1990-0540	3	DISPLAY-NUM SEG 1-CHAR .43-H	28480	5082-7650
A1A1DS9	1990-0547	0	38 LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS10	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS11	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS12	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS13	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS14	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS15	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS16	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS17	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS18	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS19	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS20	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS21	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS22	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS23	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS24	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS25	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS26	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS27	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS28	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS29	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS30	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS31	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS32	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS33	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS34	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS35	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS36	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS37	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS38	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS39	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS40	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS41	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS42	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS43	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS44	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS45	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1DS46	1990-0547	0	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	5082-4684,SEL IV
A1A1MP1	0380-0655	7	4 SPACER-SNAP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP2	0380-0655	7	SPACER-SNAP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP3	0380-0655	7	SPACER-SNAP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP4	0380-0655	7	SPACER-SNAP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP5	4040-1217	3	3 HOUSING, ANNUNCIATOR	28480	4040-1217
A1A1MP6	4040-1217	3	HOUSING, ANNUNCIATOR	28480	4040-1217
A1A1MP7	4040-1217	3	HOUSING, ANNUNCIATOR	28480	4040-1217
A1A1MP8	7120-6258	5	1 LABEL, ANNUNCIATOR	28480	7120-6258
A1A1R1	0698-4037	0	4 RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A1A1R2	0698-4037	0	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A1A1R3	0698-4037	0	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A1A1R4	0698-3438	3	21 RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A1R5	0698-4037	0	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A1A1XDS1	1200-0674	1	8 SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8
A1A1XDS2	1200-0674	1	SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8
A1A1XDS3	1200-0674	1	SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8
A1A1XDS4	1200-0674	1	SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8
A1A1XDS5	1200-0674	1	SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8
A1A1XDS6	1200-0674	1	SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8
A1A1XDS7	1200-0674	1	SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8
A1A1XDS8	1200-0674	1	SOCKET-IC 14-CONT DIP-SLDR	23880	T-8W3800-14-8

Table 6-3. Replaceable Parts (2 of 51)

Reference Designation	HP Part Number		Qty	Description	Mfr Code	Mfr Part Number
A1A2			.	DISPLAY DECODER & DRIVER(NSR, P/O A1)		
A1A2C1	0180-0104	7	4	CAPACITOR-FXD 200UF+75-10% 10VDC AL	56289	30D207G010DF2
A1A2C2	0150-0121	5	75	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C3	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C4	0180-0374	3	65	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A1A2C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C6	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C8	0160-3291	7	2	CAPACITOR-FXD 1200PF +-1% 100VDC MICA	28480	0160-3291
A1A2C9	0160-0218	2	2	CAPACITOR-FXD 2400PF +-1% 300VDC MICA	28480	0160-0218
A1A2C10	0140-0193	0	6	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A1A2C11	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A1A2C12	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A1A2C13	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A1A2C14	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A1A2C15	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A1A2C16	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C17	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C18	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2C19	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1A2J1	1251-3119	2	1	CONNECTOR 20-PIN M RECTANGULAR	28480	1251-3119
A1A2J2	1251-3105	4	2	CONNECTOR 4-PIN M POST TYPE	28480	1251-3105
A1A2JU1	1251-4268	4	2	*ONT-SET, 20-PIN	28480	1251-4268
A1A2JU2	1251-4268	4		*ONT-SET, 20-PIN	28480	1251-4268
A1A2P2	1251-4730	5	6	CONNECTOR 4-PIN F POST TYPE	28480	1251-4730
A1A2P2	1251-4551	8	108	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A1A2R1	0757-0123	3	7	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A1A2R2	0757-0460	1	13	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1A2R3	0757-0442	9	170	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A2R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A2R5	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A2R6	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A2R7	0757-0280	3	38	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R8	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R11	0757-0401	0	33	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A2R12	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A2R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A2R14	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A2R15	0698-0083	8	12	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R16	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R17	0698-0083	A		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R18	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R19	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R20	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R21	1810-0041	9	3	NETWORK-RES 9-PIN-8IP .15-PIN-SPCG	28480	1810-0041
A1A2R22	1810-0041	9		NETWORK-RES 9-PIN-8IP .15-PIN-SPCG	28480	1810-0041
A1A2R23	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R24	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R25	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R26	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R27	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R28	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R29	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R30	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R31	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R32	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R33	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R34	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R35	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R36	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R37	0683-0335	2	9	RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R38	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R39	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R40	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R41	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R42	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R43	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R44	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R45	0683-0335	2		RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A1A2R46	0757-0395	1	2	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A1A2R47	0757-0395	1		RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F

Table 6-3. Replaceable Parts (3 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A2U1	1858-0014 6	1	TRANSISTOR ARRAY	28480	1858-0014
A1A2U2	1820-1670 3	4	IC DRVR MOS DSPL DRVR HEX 1-INP	07263	75492PC
A1A2U3	1820-1670 3		IC DRVR MOS DSPL DRVR HEX 1-INP	07263	75492PC
A1A2U4	1820-1670 3		IC DRVR MOS DSPL DRVR HEX 1-INP	07263	75492PC
A1A2U5	1820-1670 3		IC DRVR MOS DSPL DRVR HEX 1-INP	07263	75492PC
A1A2U6	1821-0001 4	3	TRANSISTOR ARRAY	01928	CA3046
A1A2U7	1820-1646 3	2	IC DCDR CMOS BCD-TO-7-SEG 4-TO-7-LINE	01928	CD4055BE
A1A2U8	1820-1197 9	7	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A1A2U9	1820-1646 3		IC DCDR CMOS BCD-TO-7-SEG 4-TO-7-LINE	01928	CD4055BE
A1A2U10	1820-1436 9	4	IC SN74LS170N 16-BIT RAM TTL	01295	SN74LS170N
A1A2U11	1820-1436 9		IC SN74LS170N 16-BIT RAM TTL	01295	SN74LS170N
A1A2U12	1820-1436 9		IC SN74LS170N 16-BIT RAM TTL	01295	SN74LS170N
A1A2U13	1820-1436 9		IC SN74LS170N 16-BIT RAM TTL	01295	SN74LS170N
A1A2U14	1820-1556 4	1	IC DCDR CMOS BIN 2-TO-4-LINE DUAL 2-INP	01928	CD4555BF
A1A2U15	1820-1932 9	1	IC MV CMOS MONOSTBL RETRIG/RESET DUAL	04713	MC14538BCP
A1A2U16	1820-1112 8	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A1A2U17	1820-1317 5	4	IC MV CMOS MONO/ASTBL	01928	CD4047AE
A1A2U18	1820-1918 2	5	IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS241N
A1A2U19	1820-1437 0	3	IC MV TTL LS MONOSTBL DUAL	01295	SN74LS221N
A1A2U20	1820-1437 0		IC MV TTL LS MONOSTBL DUAL	01295	SN74LS221N
A1A2U21	1820-1437 0		IC MV TTL LS MONOSTBL DUAL	01295	SN74LS221N
A2	04942-60002 1	1	THUMBWHEEL SWITCH PC BOARD ASSEMBLY	28480	04942-60002
A2J1	1200-0768 4	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0768
A2R1	1810-0255 7	1	RESISTIVE NETWORK	28480	1810-0255
A2S1	3100-3376 6	1	SWITCH-THUMBWHEEL MOD 1 BCD W/CMPLMT MOD	28480	3100-3376
A3	04943-60124 9	1	SWITCH PC BOARD ASSEMBLY (STANDARD)	28480	04943-60124
A3	04943-60128 3	1	SWITCH PC BOARD ASSEMBLY (NLD-OPT 012)	28480	04943-60128
A3	04943-60503 8	1	SWITCH PC BOARD ASSEMBLY (OPTION 011)	28480	04943-60503
A3C1	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A3C2	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A3C3	0160-0157 8	1	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A3C4	0160-3451 1	121	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A3C5	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A3D81	1990-0442 4	14	LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
A3D82	1990-0442 4		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
A3J1	1251-3618 6	2	CONNECTOR 2-PIN M POST TYPE	28480	1251-3618
A3J2	1200-0548 8	1	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0548
A3J3	1251-3195 4		CONNECTOR 4-PIN M POST TYPE	28480	1251-3195
A3J4	1251-3192 1	3	CONNECTOR 3-PIN M POST TYPE	28480	1251-3192
A3J5	1251-3196 5	2	CONNECTOR 8-PIN M POST TYPE	28480	1251-3196
A3J6	1251-3192 1		CONNECTOR 3-PIN M POST TYPE	28480	1251-3192
A3MP1	4040-0706 3	8	BASE, LENS	28480	4040-0706
A3MP2	4040-0706 3		BASE, LENS	28480	4040-0706
A3MP3	1400-0249 0		CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249
A3P1	1251-4732 7	6	CONNECTOR 2-PIN F POST TYPE	28480	1251-4732
	1251-4551 8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P3	1251-4730 5		CONNECTOR 4-PIN F POST TYPE	28480	1251-4730
	1251-4551 8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P4	1251-4829 3	6	CONNECTOR 3-PIN F POST TYPE	28480	1251-4829
	1251-4551 8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P5	1251-4731 6	7	CONNECTOR 8-PIN F POST TYPE	28480	1251-4731
	1251-4551 8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P6	1251-4829 3		CONNECTOR 3-PIN F POST TYPE	28480	1251-4829
	1251-4551 8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3Q1	1854-0039 7	4	TRANSISTOR NPN 2N3053 SI TO-39 PD=1W	04713	2N3053
A3Q2	1854-0039 7		TRANSISTOR NPN 2N3053 SI TO-39 PD=1W	04713	2N3053
A3R1	0698-3438 3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R2	0698-3438 3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R3	0698-3438 3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R4	0698-3438 3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R5	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R6	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R7	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R8	0683-1055 5	16	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R9	0757-0199 3	33	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A3R10	0757-0438 3	35	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R11	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A3R12	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R13	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A3R14	0757-0461 2	7	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A3R15	0757-0403 2	6	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F

Table 6-3. Replaceable Parts (4 of 51)

Reference Designation	HP Part Number		Qty	Description	Mfr Code	Mfr Part Number
A3R16	0757-0279	0	10	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R17	0757-0419	0	9	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3R18	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A3R19	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A3R20	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R21	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A381	3101-2083	2	3	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2083
A382	3101-2070	7	2	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2070
A383	3101-2068	3	13	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A384	3101-2083	2		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2083
A385	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A386	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A387	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A388	3101-2071	8	3	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2071
A389	3100-3375	5	1	SWITCH-RTRY 8P77-NS .5-DIA IDX-ANG=45	28480	3100-3375
A3810	3101-2071	8		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2071
A3811	3101-2070	7		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2070
A3812	3101-2192	4	1	SWITCH-TGL SUBMIN DPDT NS 2A 250VAC PC	28480	3101-2192
A3813	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3814	5060-9436	7	2	SWITCH, PUSHBUTTON	28480	5060-9436
A3815	5060-9436	7		SWITCH, PUSHBUTTON	28480	5060-9436
A3816	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3817	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3818	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3819	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3820	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3821	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3822	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3823	3101-2083	2		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2083
A3824	3101-2068	3		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2068
A3825	3101-2071	8		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC PC	28480	3101-2071
A3T1	9100-0382	4	1	TRANSFORMER-OUTPUT	28480	9100-0382
A3U1	1826-0328	8	45	IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A3W1	8120-1595	4	12 in.	CABLE-FL-RBN 28AWG 50-CNDCT UL=2651	28480	8120-1595
A3W1	1251-2991	6	1	CONNECTOR-PC EDGE 25-CONT/ROW 2-ROWS	28480	1251-2991
A3W1	0360-1706	9	1	CABLE TRANSITION 50-TERM INSUL DSPL TYPE	28480	0360-1706
A3W2	5060-7155	3	1	CABLE R.F. WITH CONNECTOR	28480	5060-7155
A4				NOT ASSIGNED		
A5	04943-60125	0	1	MOTHER PC BOARD ASSEMBLY	28480	04943-60125
A5J2	1250-0257	3	2	CONNECTOR-RF	28480	1250-0257
A5J3	1251-3618	6		CONNECTOR 2-PIN M POST TYPE	28480	1251-3618
A5J4	1251-3192	1		CONNECTOR 3-PIN M POST TYPE	28480	1251-3192
A5J5	1251-3196	5		CONNECTOR 8-PIN M POST TYPE	28480	1251-3196
A5MP1	04942-00019	4	2	PLATE, TRANSFORMER NUT	28480	04942-00019
A5MP2	04942-00019	4		PLATE, TRANSFORMER NUT	28480	04942-00019
A5MP3	2200-0155	4	2	SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A5MP4	2200-0155	4		SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A5MP5	0403-0135	8	2	GUIDE-PC BOARD ORN POLYC .062-BD-TMKNS	28480	0403-0135
A5MP6	0403-0135	8		GUIDE-PC BOARD ORN POLYC .062-BD-TMKNS	28480	0403-0135
A5P3	1251-4732	7		CONNECTOR 2-PIN F POST TYPE	28480	1251-4732
	1251-4551	8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A5P4	1251-4829	3		CONNECTOR 3-PIN F POST TYPE	28480	1251-4829
	1251-4551	8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A5T1	9100-1309	7	1	TRANSFORME-AUD 600 OHM/600 OHM/900	28480	9100-1309
A5XA6	1251-1365	6	15	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA7	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA8	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA9	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA10	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA11	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA12	1251-2915	4	1	CONNECTOR-PC EDGE 25-CONT/ROW 2-ROWS	28480	1251-2915
A5XA13	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA14	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA15	1251-4276	4	1	CONNECTOR-PC EDGE 43-CONT/ROW 2-ROWS	28480	1251-4276
A5XA16	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA17	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA18	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA19	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA20	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365

Table 6-3. Replaceable Parts (5 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5XA21	1251-1365 6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5XA22	1251-1365 6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A5A23P1	1251-4270 8	1	CONNECTOR 10-PIN F UTILITY	28480	1251-4270
A5A23P1	1251-4272 0	10	CONTACT-CONN U/W-UTIL FEM CRP	28480	1251-4272
A6	04943-60126 1	1	INPUT PC BOARD ASSEMBLY	28480	04943-60126
A6C1	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C2	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C3	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C4	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C5	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C6	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C7	0180-0397 0	1	CAPACITOR-FXD 40UF+50-10% 200VDC AL NPOL	28480	0180-0397
A6C8	0180-0361 8	2	CAPACITOR-FXD 10UF+50-10% 350VDC AL	56289	34D106F350FJ4
A6C9	0180-0361 8		CAPACITOR-FXD 10UF+50-10% 350VDC AL	56289	34D106F350FJ4
A6C10	0140-0192 9	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A6C11	0160-2199 2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A6C12	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C13	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C14	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C15	0160-0840 6	1	CAPACITOR-FXD 834PF +-1% 100VDC MICA	28480	0160-0840
A6C16	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6CR1	1901-0040 1	55	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR2	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR3	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR4	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR5	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR6	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR7	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6J1	1251-3638 0	2	CONNECTOR 6-PIN M POST TYPE	28480	1251-3638
A6J2	1250-0257 3		CONNECTOR-RF	28480	1250-0257
A6JU1	8120-0202 8	6 in.	CABLE-SHLD 22AWG 2-CNDCT BLK-JKT	28480	8120-0202
A6JU2	8120-2497 7		CABLE-COAX 50-OHM BLK 36PF/FT	28480	8120-2497
A6K1	0490-0647 0	2	RELAY-REED 2A 500MA 200VDC 24VDC-COIL	28480	0490-0647
A6K2	0490-0648 1	5	RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A6K3	0490-0648 1		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A6K4	0490-0646 9	2	RELAY-REED 1B 500MA 200VDC 24VDC-COIL	28480	0490-0646
A6K5	0490-0646 9		RELAY-REED 1B 500MA 200VDC 24VDC-COIL	28480	0490-0646
A6L1	9100-3916 6	1	COIL/INDUCTOR 300 MH	28480	9100-3916
A6MP1	0403-0234 8	2	EXTRACTOR-PC BOARD BLK NYL .062-BD-THKNS	28480	0403-0234
A6MP2	1400-0482 3	7	CABLE TIE .062-3-DIA .14-WD NYL	28480	1400-0482
A6MP3	1400-0482 3		CABLE TIE .062-3-DIA .14-WD NYL	28480	1400-0482
A6MP4	1400-0482 3		CABLE TIE .062-3-DIA .14-WD NYL	28480	1400-0482
A6MP5	1400-0482 3		CABLE TIE .062-3-DIA .14-WD NYL	28480	1400-0482
A6P1	1251-4728 1	3	CONNECTOR 6-PIN F POST TYPE	28480	1251-4728
	1251-4551 8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A6Q1	1854-0071 7	45	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q2	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q4	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q5	1853-0336 5	9	TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A6Q6	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q7	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A6Q8	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q9	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A6Q10	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q11	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A6Q12	1853-0036 2	17	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A6Q13	1855-0078 6	2	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0078
A6R1	0757-0465 6	71	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R2	0757-0447 4	13	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R3	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R4	0698-3153 9	9	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R5	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R6	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R7	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R8	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R9	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R10	0698-3150 6	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F

Table 6-3. Replaceable Parts (6 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R11	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R12	0698-3445 2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A6R13	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R14	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R15	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R16	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R17	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R18	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R19	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R20	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R21	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R22	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R23	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R24	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R25	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R26	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R27	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R28	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R29	0699-0076 1	1	RESISTOR 605.2 .1% 1W F TC=0+-50	28480	0699-0076
A6R30	0699-0077 2	1	RESISTOR 306.5 .1% 1W F TC=0+-50	28480	0699-0077
A6R31	0698-3441 8	8	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R32	0698-3441 8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R33	0698-6911 3	1	RESISTOR 51.1K .5% .125W F TC=0+-50	28480	0698-6911
A6R34	0698-8015 2	1	RESISTOR 23.7K .5% .125W F TC=0+-50	19701	MF4C1/8-T2-2372-D
A6R35	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R36	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R37	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R38	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R39	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R40	0757-0278 9	3	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A6R41	0698-7064 5	5	RESISTOR 25.8K 1% .125W F TC = 0+-100	24546	C4-1/8-TO-2582-F
A6R42	0757-0416 7	6	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A6R43	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6T1	9100-3825 H	1	TRANSFORMER, AUDIO	28480	9100-3825
A7	04944-60007 8	1	NLD RCVR PC BOARD ASSEMBLY (OPTION 012)	28480	04944-60007
A7C1	0180-2207 5	4	CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A7C2	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A7C3	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A7C4	0160-3902 7	11	CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A7C5	0160-3902 7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A7C6	0160-0408 2	4	CAPACITOR-FXD .01UF +-1% 300VDC MICA	28480	0160-0408
A7C7	0160-2230 2	1	CAPACITOR-FXD 3300PF +-5% 300VDC MICA	28480	0160-2230
A7C8	0160-0408 2		CAPACITOR-FXD .01UF +-1% 300VDC MICA	28480	0160-0408
A7C9	0160-0408 2		CAPACITOR-FXD .01UF +-1% 300VDC MICA	28480	0160-0408
A7C10	0160-2228 8	1	CAPACITOR-FXD 2700PF +-5% 300VDC MICA	28480	0160-2228
A7C11	0160-0408 2		CAPACITOR-FXD .01UF +-1% 300VDC MICA	28480	0160-0408
A7C12	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A7C13	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A7C14	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A7C15	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A7C16	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A7C17	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A7C18	0160-4137 2	24	CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C19	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C20	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C21	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C22	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C23	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C24	0160-4606 0	6	CAPACITOR-FXD .039UF +-1% 100VDC POLYSTY	28480	0160-4606
A7C25	0160-4606 0		CAPACITOR-FXD .039UF +-1% 100VDC POLYSTY	28480	0160-4606
A7C26	0160-4606 0		CAPACITOR-FXD .039UF +-1% 100VDC POLYSTY	28480	0160-4606
A7C27	0160-4606 0		CAPACITOR-FXD .039UF +-1% 100VDC POLYSTY	28480	0160-4606
A7C28	0160-4606 0		CAPACITOR-FXD .039UF +-1% 100VDC POLYSTY	28480	0160-4606
A7C29	0160-4606 0		CAPACITOR-FXD .039UF +-1% 100VDC POLYSTY	28480	0160-4606
A7C30	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C31	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C32	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C33	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C34	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C35	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A7C36	0180-0197 8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A7C37	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2

Table 6-3. Replaceable Parts (7 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7CR1	1901-0376 6	25	DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A7CR2	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7MP1	0403-0235 9	2	EXTRACTOR-PC BOARD BRN NYL .062-BD-THKNS	28480	0403-0235
A7Q1	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7R1	2100-3109 2	24	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R2	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R3	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R4	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R5	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R6	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R7	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R8	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R9	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R10	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R11	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A7R12	2100-3056 8	7	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A7R13	2100-3056 8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A7R14	2100-3123 0	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A7R15	0757-0439 4	8	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R16	0757-0420 3	8	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A7R17	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R18	0757-0458 7	12	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A7R19	0698-4441 0	1	RESISTOR 3.74K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3741-F
A7R20	0757-0443 0	12	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A7R21	0698-3136 8	2	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A7R22	0698-3159 5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A7R23	0698-3157 3	28	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A7R24	0698-3161 9	2	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A7R25	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R26	0698-0084 9	16	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A7R27	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R28	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R29	0698-8121 9		RESISTOR 2.58K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2581-F
A7R30	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A7R31	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A7R32	0757-0289 2	9	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A7R33	0698-3152 8	4	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A7R34	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A7R35	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R36	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A7R37	0757-0440 7	3	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A7R38	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R39	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A7R40	0698-3156 2	11	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A7R41	0757-0288 1	13	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A7R42	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R43	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R44	0757-0444 1	10	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A7R45	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A7R46	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R47	0698-6461 8	4		28480	0698-6461
A7R48	0698-6461 8			28480	0698-6461
A7R49	0698-6461 8			28480	0698-6461
A7R50	0698-6461 8			28480	0698-6461
A7R51	0698-6639 2	2	RESISTOR 555.4K 1% .25W F TC=0+-25	28480	0698-6639
A7R52	0757-0441 8	3	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A7R53	0698-3456 5	1	RESISTOR 287K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2873-F
A7R54	0698-6639 2		RESISTOR 555.4K 1% .25W F TC=0+-25	28480	0698-6639
A7R55	0698-3452 1	5	RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A7R56	0757-0461 2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A7R57	0757-0439 4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R58	0757-0461 2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A7R59	0757-0439 4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R60	0757-0470 3	2	RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A7R61	0757-0200 7	4	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A7R62	0698-3457 6	7	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A7R63	0757-0439 4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R64	0698-3451 0	2	RESISTOR 133K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1333-F
A7R65	0757-0200 7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A7R66	0757-0278 9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A7R67	0757-0290 5	10	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A7R68	0757-0441 8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A7R69	0698-0083 8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A7R70	0698-0083 8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F

Table 6-3. Replaceable Parts (8 of 51)

Reference Designation	HP Part Number		Qty	Description	Mfr Code	Mfr Part Number
A7R71	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A7R72	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A7U1	1826-0469	8	9	IC 120 OP AMP T0-100	25403	ATP431
A7U2	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U3	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U4	1820-1807	8	16	IC 200 SWITCH T0-100	17856	DG200BA
A7U5	1820-1807	8		IC 200 SWITCH T0-100	17856	DG200BA
A7U6	1820-1807	8		IC 200 SWITCH T0-100	17856	DG200BA
A7U7	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A7U8	1820-1807	8		IC 200 SWITCH T0-100	17856	DG200BA
A7U9	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U10	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U11	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U12	1826-0111	7	9	IC 1458 OP AMP T0-99	04713	MC1458G
A7U13	1826-0111	7		IC 1458 OP AMP T0-99	04713	MC1458G
A7U14	1820-0493	4	21	IC OP AMP 8-DIP-P	27014	LM307N
A7U15	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U16	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U17	1826-0469	8		IC 120 OP AMP T0-100	25403	ATP431
A7U18	1826-0111	7		IC 1458 OP AMP T0-99	04713	MC1458G
A7U19	1826-0111	7		IC 1458 OP AMP T0-99	04713	MC1458G
A7U20	1826-0111	7		IC 1458 OP AMP T0-99	04713	MC1458G
A7U21	1826-0111	7		IC 1458 OP AMP T0-99	04713	MC1458G
A7W1	8120-0124	3	1	CABLE-COAX 50-OHM BLK 30PF/FT	28480	8120-0124
	0362-0499	9	1	SLEEVE-METAL CU RED INSUL	28480	0362-0499
A7A17P3	1251-4733	8	1	CONNECTOR 2-PIN F POST TYPE	28480	1251-4733
	1251-4551	8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
	1251-3720		1	CONNECTOR SINGLE CONT.	28480	1251-3728
	0360-0124		1	TERM SOLDER STUD	28480	0360-0124
A8	04942-60008	7	1	MODEM PC BOARD ASSEMBLY	28480	04942-60008
A8C1	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A8C2	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A8C3	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A8C4	0160-0939	4	1	CAPACITOR-FXD 430PF +-5% 300VDC MICA	28480	0160-0939
A8C5	0180-0291	3	6	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A8C6	0160-4357	8	3	CAPACITOR-FXD .01UF +-2% 100VDC	28480	0160-4357
A8C7	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C8	0160-4357	8		CAPACITOR-FXD .01UF +-2% 100VDC	28480	0160-4357
A8C9	0160-4357	8		CAPACITOR-FXD .01UF +-2% 100VDC	28480	0160-4357
A8C10	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C11	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C12	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A8C13	0160-3902	7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A8C14	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C15	0160-3902	7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A8C16	0160-3902	7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A8C17	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C18	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C19	0170-0066	9	1	CAPACITOR-FXD .027UF +-10% 200VDC POLYE	28480	0170-0066
A8C20	0160-3902	7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A8C21	0180-2206	4	7	CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A8C22	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C23	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C24	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A8C25	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C26	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C27	0160-3548	7	10	CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A8C28	0160-3548	7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A8C29	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C30	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C31	0160-3548	7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A8C32	0160-3548	7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A8C33	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C34	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C35	0160-2732	9	6	CAPACITOR-FXD 1250PF +-1% 500VDC MICA	28480	0160-2732
A8C36	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C37	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C38	0160-2732	9		CAPACITOR-FXD 1250PF +-1% 500VDC MICA	28480	0160-2732
A8C39	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C40	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C41	0160-2721	6	6	CAPACITOR-FXD 5100PF +-5% 500VDC MICA	28480	0160-2721
A8C42	0160-2721	6		CAPACITOR-FXD 5100PF +-5% 500VDC MICA	28480	0160-2721
A8C43	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C44	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C45	0160-2721	6		CAPACITOR-FXD 5100PF +-5% 500VDC MICA	28480	0160-2721

Table 6-3. Replaceable Parts (9 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8C46	0160-2721 6		CAPACITOR-FXD 5100PF +-5% 500VDC MICA	28480	0160-2721
A8C47	0160-2721 6		CAPACITOR-FXD 5100PF +-5% 500VDC MICA	28480	0160-2721
A8C48	0160-2721 6		CAPACITOR-FXD 5100PF +-5% 500VDC MICA	28480	0160-2721
A8C49	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C50	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C51	0180-0228 6	11	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A8C52	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C53	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C54	0160-2732 9		CAPACITOR-FXD 1250PF +-1% 500VDC MICA	28480	0160-2732
A8C55	0160-2732 9		CAPACITOR-FXD 1250PF +-1% 500VDC MICA	28480	0160-2732
A8C56	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C57	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C58	0160-2732 9		CAPACITOR-FXD 1250PF +-1% 500VDC MICA	28480	0160-2732
A8C59	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C60	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C61	0160-2732 9		CAPACITOR-FXD 1250PF +-1% 500VDC MICA	28480	0160-2732
A8C62	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A8C63	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C64	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C65	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8C66	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A8CR1	1902-3149 9	2	DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	28480	1902-3149
A8CR2	1902-3149 9		DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	28480	1902-3149
A8CR3	1902-0041 4	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A8CR4	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR5	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR6	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR7	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR8	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR9	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR10	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR11	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR12	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8J1	1251-3638 0		CONNECTOR 6-PIN M POST TYPE	28480	1251-3638
A8MP1	0403-0238 2	3	EXTRACTOR-PC BOARD RED NYL .062-BD-THKNS	28480	0403-0238
A8Q1	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q2	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q3	1854-0071 7 3		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8R1	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R2	0757-0461 2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A8R3	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A8R4	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8R5	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R6	0757-0463 4	3	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A8R7	2100-3161 6	5	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A8R8	0757-0459 8	3	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A8R9	2100-3103 6	6	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A8R10	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R11	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R12	0698-3136 3		RESISTOR 17.8K 1% .125W F TC = 0+-100	28480	0698-3136
A8R13	0757-0442 1		RESISTOR 10K 1% .125W F TC = 0+-100	24546	C4-1/8-T0-1002-F
A8R14	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R15	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R16	0698-3429 2	2	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A8R17	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R18	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8R19	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R20	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R21	0698-3429 2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A8R22	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R23	0757-0290 5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R24	0757-0290 5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R25	0757-0290 5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R26	0757-0444 1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A8R27	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A8R28	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A8R29	0698-3158 4	4	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A8R30	0757-0200 7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A8R31	0757-0288 9		RESISTOR 9.09K 1% .125W F TC = 0+-100	24546	C4-1/8-TO 9092-F
A8R32	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8R33	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R34	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R35	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F

Table 6-3. Replaceable Parts (10 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R36	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R37	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R38	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R39	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R40	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R41	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R42	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R43	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R44	0698-3450 9	11	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A8R45	0757-0422 5	3	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A8R46	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R47	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R48	0698-3453 2	4	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A8R49	0811-0691 6	8	RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R50	0811-0691 6		RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R51	0811-0691 6		RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R52	0811-0691 6		RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R53	0698-3453 2		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A8R54	0811-0691 6		RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R55	0811-0691 6		RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R56	0811-0691 6		RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R57	0811-0691 6		RESISTOR 7,998K .1% .062W PWW TC=0+-15	28480	0811-0691
A8R58	0698-3457 6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A8R59	0698-3457 6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A8R60	0811-0686 9	12	RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A8R61	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A8R62	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R63	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R64	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A8R65	0757-0288 1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R66	0757-0467 8	4	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A8R67	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A8R68	0757-0288 1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R69	0757-0467 8		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A8R70	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A8R71	0757-0288 1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R72	0757-0467 8		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A8R73	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R74	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R75	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R76	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R77	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R78	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R79	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R80	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R81	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R82	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A8R83	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A8R84	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R85	0698-3457 6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A8R86	0698-3457 6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A8R87	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A8R88	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A8R89	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R90	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R91	0698-3457 6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A8R92	0698-3457 6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A8R93	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A8R94	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A8R95	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R96	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R97	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R98	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R99	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R100	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R101	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R102	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R103	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R104	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R105	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R106	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A8R107	0698-3444 1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A8R108	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R109			NOT ASSIGNED		
A8R110			NOT ASSIGNED		

Table 6-3. Replaceable Parts (11 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8U1	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U2	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U3	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U4	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U5	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U6	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U7	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U8	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A8U9	1820-1807 8		IC 200 SWITCH TO-100	17856	DG200BA
A8U10	1826-0180 0	4	IC 555 8-DIP-P	18324	NE555V
A8U11	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U12	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U13	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U14	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U15	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U16	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8U17	1826-0321 1	5	IC COMPARATOR 14-DIP-P	01928	CA3099E
A8U18	1826-0180 0		IC 555 8-DIP-P	18324	NE555V
A8U19	1826-0321 1		IC COMPARATOR 14-DIP-P	01928	CA3099E
A8U20	1820-1188 8	1	IC PL LOOP 16-DIP-P	01928	CD4046AF
A8U21	1820-0931 7	3	IC CNTR CMOS BIN UP/DOWN SYNCHRO	01928	CD4029AE
A8U22	1820-0931 7		IC CNTR CMOS BIN UP/DOWN SYNCHRO	01928	CD4029AE
A8U23	1820-0931 7		IC CNTR CMOS BIN UP/DOWN SYNCHRO	01928	CD4029AE
A8U24	1820-1690 7	1	IC MICPROC-ACCESS NMOS 8-BIT	04713	MC6850L
A8U25	1820-0939 5	7	IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD4013AF
A8U26	1820-1657 7	12	IC GATE CMOS NOR + INV		MC14572
A8U27	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A8XU22, 23	1200-0473	2	SOCKET DIP 16 PIN	28480	1200-0473
A8VR1	1990-0449 1	4	OPTO-ISOLATOR LED-PCNDCT IF=50MA-MAX	03911	CLM8000
A9	04942-60009 8	1	FILTER MODULATOR PC BOARD ASSEMBLY	28480	04942-60009
A9C1	0150-0050 9	2	CAPACITOR-FXD 1000PF +80-20% 1KVDC CER	28480	0150-0050
A9C2	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A9C3	0180-1746 5	14	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C4	0160-2251 7	1	CAPACITOR-FXD 5.6PF +-.25PF 500VDC CER	28480	0160-2251
A9C5	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A9C6	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A9C7	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C8			NOT ASSIGNED		
A9C9	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A9C10	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C11	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A9C12	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A9C13	0160-2227 7	2	CAPACITOR-FXD 2400PF +-5% 300VDC MICA	28480	0160-2227
A9C14	0160-2227 7		CAPACITOR-FXD 2400PF +-5% 300VDC MICA	28480	0160-2227
A9C15	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C16	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C17	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C18	0160-0161 4	2	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A9C19	0160-2453		CAPACITOR-FXD 0.22UF		
A9CR1	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR2	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR3	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR4	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR5	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR6	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR7	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR8	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR9	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR10	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR11	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9MP1	0403-0236 0	3	EXTRACTOR-PC BOARD ORN NYL .062-BD-THKNS	28480	0403-0236
A9Q1	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9R1	1810-0223 9	10	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A9R2	0757-0464 5	3	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A9R3	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R4	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R5	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R6	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R7	1810-0226 2	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	28480	1810-0226
A9R8	0757-0123 3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A9R9	2100-3056 8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A9R10	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F

Table 6-3. Replaceable Parts (12 of 51)

Reference Designation	HP Part Number		Qty	Description	Mfr Code	Mfr Part Number
A9R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R14	0698-4002	9	4	RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F
A9R15	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F
A9R16	0698-3154	0	3	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A9R17				NOT ASSIGNED		
A9R18				NOT ASSIGNED		
A9R19	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A9R20	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A9R21	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A9R22	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R23	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A9R24	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R25	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F
A9R26	0698-3155	5		RESISTOR 4.64K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-4641-F
A9R27	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A9R28	0757-0274	5	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A9R29	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A9R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R31	0698-3162	0	3	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A9R32	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A9R33	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R34	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A9R35	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A9R36	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A9R37	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A9R38	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R39	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A9R40	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100		
A9R42	0698-3160			RESISTOR 31.6K 1% .125W F TC=+-100	24546	C4-1/8-T0-1002-F
A9R43	0757 0401			RESISTOR 100 1% .125W F TC=0+-100		
A9TP1	0360-0124	3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A9U1	1826-0295	8	1	IC MULTIPLIER TO=100	24355	AD533JH
A9U2	1826-0328	8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A9U3	1826-0309	5	2	IC OP AMP TO=99	24355	AD518J
A9U4	1820-0976	0	3	IC SHF-RGTR CMOS D-TYPE SERIAL-IN	01928	CD4015AF
A9U5	1820-0976	0		IC SHF-RGTR CMOS D-TYPE SERIAL-IN	01928	CD4015AF
A9U6	1826-0328	8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A9U7	1826-0328	8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A9U8	1820-0936	2	1	IC CNTR CMOS BIN SYNCHRO NEG-EDGE-TRIG	01928	CD4024AF
A9U9	1820-0949	7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A9U10	1820-1807	8		IC 200 SWITCH TO=100	17856	DG200BA
A9U11	1820-0949	7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A9U12	1820-1807	8		IC 200 SWITCH TO=100	17856	DG200BA
A9U13	1820-1807	8		IC 200 SWITCH TO=100	17856	DG200BA
A9VR1	1990 0643	1		OPTO-ISOLATOR LED-PCNDCT	03911	
A10	04942-60010	1	1	TRANSMIT CONTROL PC BOARD ASSEMBLY	28480	04942-60010
A10C1	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A10C2	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A10C3	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A10C4	0150-0050	9		CAPACITOR-FXD 1000PF +80-20% 1KVDC CER	28480	0150-0050
A10C5	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A10C6	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A10C7	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A10C8	0160-0168	1	2	CAPACITOR-FXD .1UF +-10% 200VDC POLYE	28480	0160-0168
A10C9	0160-0168	1		CAPACITOR-FXD .1UF +-10% 200VDC POLYE	28480	0160-0168
A10J1	1200-0588	6	5	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0588
A10MP1	0403-0239	3	2	EXTRACTOR-PC BOARD YEL NYL .062-BD-THKNS	28480	0403-0239
A10R1	1810-0223	9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A10R2	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A10R3	1810-0223	9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A10R4	1810-0225	1	5	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0225
A10R5	0698-4491	0	1	RESISTOR 30.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3092-F
A10R6	0698-3155	1	4	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A10R7	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A10R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A10R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A10U1	1820-0939	5		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD4013AF
A10U2	1820-1328	8	4	IC CNTR CMOS BIN 4-BIT	04713	MC14584CP
A10U3	1820-0938	4	4	IC FF CMOS J-K M/S POS-EDGE-TRIG DUAL	01928	CD4027AE
A10U4	1820-1328	8		IC CNTR CMOS BIN 4-BIT	04713	MC14584CP
A10U5	1820-0939	5		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD4013AF

Table 6-3. Replaceable Parts (13 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10U6	1820-1328 8		IC CNTR CMOS BIN 4-BIT	04713	MC14536CP
A10U7	1820-0938 4		IC FF CMOS J-K M/S POS-EDGE-TRIG DUAL	01928	CD4027AE
A10U8	1820-2275 5	2	IC CNTR DECD ASYNCHRO	27014	74C90
A10U9	1820-0939 5		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD4013AF
A10U10	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A10U11	1820-0976 0		IC SHF-RGTR CMOS D-TYPE SERIAL-IN	01928	CD4015AF
A10U12	1820-1693 0	11	IC LCH CMOS D-TYPE DUAL 4-BIT	04713	MC14508BCL
A10U13	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A10U14	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558NB
A10U15	1820-2275 5		IC CNTR DECD ASYNCHRO	27014	74C90
A11	04943-60011 3	1	OUTPUT PC BOARD ASSEMBLY	28480	04943-60011
A11C1	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C2	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C3	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A11C4	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A11C5	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C6	0160-2263 1	1	CAPACITOR-FXD 18PF +-5% 500VDC CER 0+-30	28480	0160-2263
A11C7	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C8	0160-2244 8	1	CAPACITOR-FXD 3PF +-.25PF 500VDC CER	28480	0160-2244
A11C9	0180-2207 5		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A11C10	0180-2207 5		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A11C11	0180-2207 5		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A11C12	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A11C13	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A11C14	0180-2634 2	1	CAPACITOR-FXD 85UF+50-10% 200VDC AL NPOL	28480	0180-2634
A11C15	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C16	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11CR1	1910-0016 0	2	DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A11CR2	1910-0016 0		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A11CR3	1902-0025 4	4	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A11CR4	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR5	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR6	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR7	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR8	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR9	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR10	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR11	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11K1	0490-0648 1		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A11K2	0490-0648 1		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A11K3	0490-0648 1		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A11MP1	0403-0237 1	2	EXTRACTOR-PC BOARD GRN NYL .062-BD-THKNS	28480	0403-0237
A11MP2	1400-0482 3		CABLE TIE .062-3-DIA .14-WD NYL	28480	1400-0482
A11MP3	1400-0482 3		CABLE TIE .062-3-DIA .14-WD NYL	28480	1400-0482
A11MP4	1200-0173 5	2	INSULATOR-XSTR DAP-GL	28480	1200-0173
A11MP5	1200-0173 5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A11Q1	1854-0039 7		TRANSISTOR NPN 2N30538 SI TO-39 PD=1W	04713	2N3053
A11Q2	1854-0039 7		TRANSISTOR NPN 2N30538 SI TO-39 PD=1W	04713	2N3053
A11Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q4	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A11Q5	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q6	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A11Q7	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q8	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A11Q9	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A11Q10	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q11	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q12	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11R1	1810-0223 9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A11R2	0698-3160 8	4	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A11R3	0698-3449 6	1	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A11R4	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R5	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R6	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A11R7	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R8	0698-3452 1		RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A11R9	0698-3158 4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A11R10	2100-3103 6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A11R11	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R12	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R13	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R14	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R15	0698-8711 5	1	RESISTOR 6.401K .1% .125W F TC=0+-25	28480	0698-8711

Table 6-3. Replaceable Parts (14 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R16	0698-6348 0	2	RESISTOR 3K .1% .125W F TC=0+-25	28480	0698-6348
A11R17	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A11R18	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R19	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R20	0757-0420 3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A11R21	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A11R22	0698-3158 4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A11R23	0757-0416 7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A11R24	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A11R25	0698-3437 2	3	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R26	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R27	0757-0123 3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A11R28	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A11R29	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R30	0698-7408 5	1	RESISTOR 600 .1% .125W F TC=0+-50	19701	MF4C1/8-T2-600R-B
A11R31	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A11R32	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11R33	0698-3437 2		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R34	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A11R35	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R36	0698-3437 2		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R37	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R38	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A11R39	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R40	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R41	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R42	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R43	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R44	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A11R45	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11R46	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R47	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R48	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R49	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R50	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A11R51	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11R52	0757-0346 2	8	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A11R53	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R54	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R55	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R56	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R57	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A11R58	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11R59	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R60	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R61	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R62	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R63	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R64	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R65	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A11R66	0757-0416 7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A11R67	0757-0424 7	2	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A11TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A11U1	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A11U2	1820-1144 6	2	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74L802N
A11U3	1820-1547 3	5	IC MUXR/DATA-SEL CMOS	04713	MC14051BCL
A11U4	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A11U5	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A11U6	1820-1547 1		IC MUXR/DATA-SEL CMOS	04713	MC14051BCL
A11U7	1820-1807 H		IC 200 SWITCH TO-100	17856	DG200BA
A11VR1	1990-0449 1		OPTO-ISOLATOR LED-PCNDCT IF=50MA-MAX	03911	CLM6000
A12	04943-60012 H	1	FRONT PANEL DECODER PC BD, ASSEMBLY	28480	04943-60012
A12C1	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A12C2	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A12C3	0160-0127 2	9	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A12C4	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A12C5	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A12C6	0160-2225 5	2	CAPACITOR-FXD 2000PF +-5% 300VDC MICA	28480	0160-2225
A12C7	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A12C8	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A12C9	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A12C10	0180-2206 4		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2

Table 6-3. Replaceable Parts (15 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12CR1	1902-0064 1	3	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	28480	1902-0064
A12CR2	1901-0029 6	8	DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A12CR3	1901-0029 6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A12CR4	1901-0029 6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A12CR5	1901-0029 6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A12CR6	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12K1	0490-0647 0		RELAY-REED 2A 500MA 200VDC 24VDC-COIL	28480	0490-0647
A12MP1	0403-0240 6	3	EXTRACTOR-PC BOARD BLU NYL .062-BD-THKNS	28480	0403-0240
A12MP2	1205-0085 8		HEAT SINK TO-66-PKG	28480	1205-0085
A12MP3	2360-0195 0		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A12MP4	2360-0195 0		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A12MP5	2360-0199 4	3	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A12MP6	2360-0199 4		SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A12MP7	2420-0015 1		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A12MP8	2420-0015 1		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A12MP9	2420-0015 1		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A12Q1	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q2	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q4	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q5	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q6	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q7	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q8	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q9	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q10	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q11	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q12	1854-0643 3	2	TRANSISTOR NPN	28480	1854-0643
A12Q13	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q14	1853-0336 5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A12R1	0757-0394 0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A12R2	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R3	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R4	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A12R5	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A12R6	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R7	0757-0420 3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A12R8	0757-0444 1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A12R9	0698-0083 8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R10	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R11	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R12	0757-0346 2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12R13	0757-0346 2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12R14	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R15	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R16	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R17	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R18	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A12R19	2100-3154 7	8	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A12R20	0757-0274 5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A12R21	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R22	0698-3243 8	3	RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1783-F
A12R23	0698-3454 3	7	RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A12R24	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A12R25	0698-3433 8	2	RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A12R26	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A12R27	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A12R28	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R29	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A12R30	0757-0419 0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A12R31	1810-0125 0	3	NETWORK-RES 8-PIN-SIP .125-PIN-SPCG	28480	1810-0125
A12R32	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A12R33	1810-0041 9		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0041
A12R34	1810-0125 0		NETWORK-RES 8-PIN-SIP .125-PIN-SPCG	28480	1810-0125
A12R35	1810-0125 0		NETWORK-RES 8-PIN-SIP .125-PIN-SPCG	28480	1810-0125
A12R36	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A12R37	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A12T1	9100-3822 3	2	XFMR-FERRITE: L=687UH@1KHZ	2484A	9100-3822
	9170-0554 9	4	COVER, TOROID MOD	28480	9170-0554
A12U1	1820-1355 1	1	IC ENCDR CMOS 8-BIT	04713	MC14532BCP
A12U2	1820-1491 6	7	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A12U3	1820-1491 6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A12U4	1820-1491 6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A12U5	1820-1491 6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N

Table 6-3. Replaceable Parts (16 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13	04943-60013 5	1	TRANSMITTER & LATCH PC BOARD ASSEMBLY	28480	04943-60013
A13C1	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C2	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C3	0160-2204 0	10	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A13C4	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A13C5	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C6	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C7	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C8	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C9	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C10	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C11	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C12	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C13	0160-2218 6	2	CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A13C14	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C15	0160-3071 1	2	CAPACITOR-FXD 10UF +-10% 100VDC	01448	17U106K
A13C16	0160-0127 2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A13C17	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C18	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C19	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C20	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C21	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13C22	0160-2218 6		CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A13C23	0160-0127 2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A13C24	0180-0159 2	1	CAPACITOR-FXD 220UF+-20% 10VDC TA	56289	150D227X001B2
A13C25	0160-0127 2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A13C26	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A13CR1	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A13CR2	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A13CR3	1901-0049 0	2	DIODE-PWR RECT 50V 750MA DO-29	28480	1901-0049
A13CR4	1901-0049 0		DIODE-PWR RECT 50V 750MA DO-29	28480	1901-0049
A13J1	1200-0564 8	2	SOCKET-IC 8-CONT DIP-SLDR	28480	1200-0564
A13J2	1200-0588 6		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0588
A13J3	1200-0588 6		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0588
A13MP1	0403-0241 7	2	EXTRACTOR-PC BOARD VIO NYL .062-BD-THKNS	28480	0403-0241
A13MP2	0403-0241 7		EXTRACTOR-PC BOARD VIO NYL .062-BD-THKNS	28480	0403-0241
A13MP3	1400-0482 3		CABLE TIE .062-3-DIA .14-WD NYL	28480	1400-0482
A13Q1	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q2	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A13Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A13Q4	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A13R1	1810-0223 9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A13R2	1810-0223 9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A13R3	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R4	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R5	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R6	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A13R7	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R8	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R9	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R10	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A13R11	1810-0055 5	5	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A13R12	0698-3160 8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A13R13	0757-0467 8		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A13R14	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A13R15	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A13R16	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R17	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A13R18	0698-6360 6	16	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A13R19	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R20	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A13R21	0698-6630 3	1	RESISTOR 20K .1% .125W F TC=0+-25	28480	0698-6630
A13R22	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R23	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A13R24	0698-6627 8	1	RESISTOR 25K .1% .125W F TC=0+-25	28480	0698-6627
A13R25	0698-4009 6	1	RESISTOR 50K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5002-F
A13R26	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A13R27	0757-0472 5	1	RESISTOR 200K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2003-F
A13R28	0698-4011 0	1	RESISTOR 250K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2503-F
A13R29	0683-5145 2	1	RESISTOR 510K 5% .25W FC TC=-800/+900	01121	CB5145
A13R30	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R31	0683-2055 7	4	RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A13R32	0683-2455 1	1	RESISTOR 2.4M 5% .25W FC TC=-900/+1100	01121	CB2455
A13R33	0683-4755 8	1	RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A13R34	0683-1065 7	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A13R35	0683-2265 1	5	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265

Table 6-3. Replaceable Parts (17 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13R36	0698-3159 5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A13R37	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R38	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A13R39	0698-3159 5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A13R40	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R41	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A13R42	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R43	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R44	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R45	0698-3136 8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A13R46	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R47	0698-3154 0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A13R48	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A13R49	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A13R50	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A13R51	0698-3154 0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A13R52	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R53	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A13R54	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R55	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R56	1810-0223 9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A13R57	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A13TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP2	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP3	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP4	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP5	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP6	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP7	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP8	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13U1	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A13U2	1820-1648 5	1	IC OSC	52063	XR-2207CP
A13U3	1826-0182 2	2	IC OP AMP TO-99	24355	AS40J
A13U4	1820-1325 5	1	IC SW CMOS BILATL QUAD	01928	CD4066AE
A13U5	1820-0944 2	3	IC GATE CMOS NOR TPL 3-INP	01928	CD4025AF
A13U6	1820-0943 1	2	IC GATE CMOS NAND TPL 3-INP	01928	CD4023AF
A13U7	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A13U8	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A13U9	1818-2268 2	1	IC, ROM, 512 X 8	28480	1818-2268
A13U10	1820-1649 6	1	IC CNTR CMOS DIV-X-N SYNCHRO	01928	CD4059AD
A13U11	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A13U12	1820-0946 4	1	IC GATE CMOS NOR QUAD 2-INP	01928	CD4001AF
A13U13	1820-0939 5		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD4013AF
A13U14	1820-1114 0	1	IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	04713	MC14516CP
A13U15	1820-1189 9	3	IC CNTR CMOS BCD UP/DOWN SYNCHRO	04713	MC14510CP
A13U16	1820-1387 9	1	IC GATE CMOS AND-OR 4-BIT	04713	MC14519BCP
A13U17	1820-0939 5		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD4013AF
A13U18	1820-0939 5		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD4013AF
A13U19	1820-1189 9		IC CNTR CMOS BCD UP/DOWN SYNCHRO	04713	MC14510CP
A13U20	1820-1189 9		IC CNTR CMOS BCD UP/DOWN SYNCHRO	04713	MC14510CP
A13U21	1820-0757 5	4	IC DRVR TTL L 8-BIT	28480	1820-0757
A13U22	1820-0757 5		IC DRVR TTL L 8-BIT	28480	1820-0757
A13U23	1820-0943 1		IC GATE CMOS NAND TPL 3-INP	01928	CD4023AF
A13U24	1820-1199 1	7	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A13U25	1820-1693 0		IC LCM CMOS D-TYPE DUAL 4-BIT	04713	MC14508BCL
A13U26	1820-1693 0		IC LCM CMOS D-TYPE DUAL 4-BIT	04713	MC14508BCL
A13U27	1820-0938 4		IC FF CMOS J-K M/S POS-EDGE-TRIG DUAL	01928	CD4027AE
A13U28	1820-1282 3	1	IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN74LS109N
A13U29	1820-1144 6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A14	04942-60014 5	1	ENVELOPE DELAY PC BOARD ASSEMBLY	28480	04942-60014
A14BP1	0340-0060 4	3	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	28480	0340-0060
A14BP2	0340-0060 4		TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	28480	0340-0060
A14C1	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A14C2	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A14C3	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C4	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C5	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C6	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C7	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C8	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C9	0160-0943 0	5	CAPACITOR-FXD .03UF +-1% 100VDC MICA	28480	0160-0943
A14C10	0160-0943 0		CAPACITOR-FXD .03UF +-1% 100VDC MICA	28480	0160-0943

Table 6-3. Replaceable Parts (18 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14C11	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C12	0160-4397 6	12	CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A14C13	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A14C14	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C15	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C16	0160-0127 2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A14C17	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C18	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C19	0180-0376 5	1	CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A14C20	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C21	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C22	0160-3510 3	5	CAPACITOR-FXD 3UF +-10% 50VDC MET-POLYC	28480	0160-3510
A14C23	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C24	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C25	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C26	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C27	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C28	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C29	0160-3510 3		CAPACITOR-FXD 3UF +-10% 50VDC MET-POLYC	28480	0160-3510
A14C30	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C31	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C32	0160-3510 3		CAPACITOR-FXD 3UF +-10% 50VDC MET-POLYC	28480	0160-3510
A14C33	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C34	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C35	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C36	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A14C37	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C38	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C39	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C40	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A14C41	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C42	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C43	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C44	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C45	0160-0161 4		CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A14C46	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A14C47	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C48	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A14C49	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C50	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C51	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A14C52	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C53	0160-3510 3		CAPACITOR-FXD 3UF +-10% 50VDC MET-POLYC	28480	0160-3510
A14C54	0160-2213 1	2	CAPACITOR-FXD 620PF +-5% 300VDC MICA	28480	0160-2213
A14CR1	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR2	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR3	1902-0025 4		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A14CR4	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR5	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR6	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A14CR7	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A14CR8	1902-0025 4		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A14CR9	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR10	1901-0539 3	1	DIODE-SCHOTTKY	28480	1901-0539
A14J01	1251-3720 1	7	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-3720
A14J02	1251-3720 1		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-3720
A14J03	1251-3720 1		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-3720
A14J04	1251-3720 1		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-3720
A14MP1	0403-0242 M	2	EXTRACTOR-PC BOARD GRA NYL .062-BD-THKNS	28480	0403-0242
A14MP2	0403-0242 M		EXTRACTOR-PC BOARD GRA NYL .062-BD-THKNS	28480	0403-0242
A14Q1	1855-0205 1	1	TRANSISTOR J-FET P-CHAN D-MODE TO-72 SI	17856	VCR3P
A14Q2	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A14Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A14Q4	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A14Q5	1855-0305 2	1	TRANSISTOR J-FET 2N4117A N-CHAN D-MODE	17856	2N4117A
A14R1	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A14R2	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R3	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R4	0698-3454 3		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R5	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A14R6	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A14R7	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A14R8	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A14R9	0811-0685 8	4	RESISTOR 19.1K .25% .062W PWW	28480	0811-0685
A14R10	0811-0685 8		RESISTOR 19.1K .25% .062W PWW	28480	0811-0685

Table 6-3. Replaceable Parts (19 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14R11	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R12	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R13	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R14	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R15	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R16	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R17	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R18	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R19	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R20	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A14R21	0757-0440 7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A14R22	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A14R23	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R24	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R25	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R26	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A14R27	0698-3441 8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R28	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R29	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A14R30	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R31	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R32	0698-3441 8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R33	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R34	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R35	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R36	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R37	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R38	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R39	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R40	0698-3441 8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R41	0698-3441 8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R42	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R43	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R44	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R45	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R46	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R47	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R48	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R49	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R50	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R51	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R52	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R53	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R54	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R55	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R56	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R57	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R58	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A14R59	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R60	0683-3955 8	1	RESISTOR 3.9M 5% .25W FC TC=-900/+1100	01121	CB3955
A14R61	0698-3460 1	2	RESISTOR 422K 1% .125W F TC=0+-100	28480	0698-3460
A14R62	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A14R63	0811-0686 9		RESISTOR 63.662K .25% .062W PWW TC=0+-20	28480	0811-0686
A14R64	0698-3460 1		RESISTOR 422K 1% .125W F TC=0+-100	28480	0698-3460
A14R65	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A14R66	0757-0290 5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A14R67	0698-3162 0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A14R68	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A14R69	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A14R70	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A14R71	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R72	0757-0420 3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A14R73	0757-0485 0	3	RESISTOR 681K 1% .125W F TC=0+-100	28480	0757-0485
A14R74	0698-3454 3		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R75	0698-3454 3		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R76	0811-0685 8		RESISTOR 19.1K .25% .062W PWW	28480	0811-0685
A14R77	0811-0684 7	1	RESISTOR 17.8K .25% .062W PWW	28480	0811-0684
A14R78	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A14R79	0698-6475 4	6	RESISTOR 19.1K 1% .125W F TC=0+-50	28480	0698-6475
A14R80	0698-6475 4		RESISTOR 19.1K 1% .125W F TC=0+-50	28480	0698-6475
A14R81	0698-3458 7	1	RESISTOR 348K 1% .125W F TC=0+-100	28480	0698-3458
A14R82	0757-0485 0		RESISTOR 681K 1% .125W F TC=0+-100	28480	0757-0485
A14R83	0698-3454 3		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R84	0757-0485 0		RESISTOR 681K 1% .125W F TC=0+-100	28480	0757-0485
A14R85	0811-0683 6	1	RESISTOR 18.2K .25% .062W PWW	28480	0811-0683

Table 6-3. Replaceable Parts (20 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14R86	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A14R87	0811-0685 8		RESISTOR 19.1K .25% .062W PWW	28480	0811-0685
A14R88	0698-6475 4		RESISTOR 19.1K 1% .125W F TC=0+-50	28480	0698-6475
A14R89	0698-6475 4		RESISTOR 19.1K 1% .125W F TC=0+-50	28480	0698-6475
A14R90	0698-3441 8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R91	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R92	0757-0402 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R93	0698-3441 8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R94	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R95	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A14R96	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R97	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R98	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP2	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP3	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP4	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP5	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP6	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP7	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP8	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP9	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP10	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP11	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP12	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14U1	1820-0403 6		IC OP AMP 8-DIP-P	27014	LM307N
A14U2	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A14U3	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A14U4	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A14U5	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A14U6	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A14U7	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A14U8	1821-0001 4		TRANSISTOR ARRAY	01928	CA3046
A14U9	1826-0321 1		IC COMPARATOR 14-DIP-P	01928	CA3099E
A14U10	1820-1807 8		IC 200 SWITCH TO-100	17856	DG200BA
A14U11	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A14U12	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A14U13	1826-0321 1		IC COMPARATOR 14-DIP-P	01928	CA3099E
A14U14	1826-0182 2		IC OP AMP TO-99	24355	A540J
A14U15	1820-1434 7	1	IC CNTR TTL LS DIV-X-12 ASYNCHRO	01295	SN74LS92N
A14U16	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A14U17	1820-1330 2	1	IC GATE CMOS EXCL-OR QUAD 2-INP	04713	MC14507CP
A14U18	1820-1317 5		IC MV CMOS MONO/ASTBL	01928	CD4047AE
A14U19	1820-1420 1	1	IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC145188CP
A14U20	1820-1122 0	1	IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC145188CP
A14U21	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A14U22	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A14U23	1820-1813 6	1	IC FF CMOS J-K POS-EDGE-TRIG	07263	4027DC
A14U24	1826-0276 5	1	IC 78L05A V RGLTR TO-92	04713	MC7805ACP
A14VR1	1990-0449 1		OPTO-ISOLATOR LED-PCNDCT IF=50MA-MAX	03911	CLM8000
A15	04943-60015 7	1	MICROPROCESSOR PC BOARD ASSEMBLY	28480	04943-60015
A15C1	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A15C2	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C3	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A15C4	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C5	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C6	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A15C7	0180-0229 7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A15C8	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C9	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C10	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C11	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C12	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C13	0160-2204 0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A15C14	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C15	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15J1	1251-3141 0	1	CONNECTOR 50-PIN M RECTANGULAR	28480	1251-3141
A15J2	1251-4429 9	1	CONNECTOR 20-PIN M POST TYPE	28480	1251-4429
A15J3	1251-4399 2	3	CONNECTOR 8-PIN M POST TYPE	28480	1251-4399
A15JU6	1251-4787 2	2		28480	1251-4787
A15JU7	1251-4787 2			28480	1251-4787

Table 6-3. Replaceable Parts (21 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15MP1	0403-0233 7	2	EXTRACTOR-PC BOARD NAT NYL .062-BD-THKNS	28480	0403-0233
A15MP2	0403-0233 7		EXTRACTOR-PC BOARD NAT NYL .062-BD-THKNS	28480	0403-0233
A15R1	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A15R2	0683-1055 5		RESISTOR 1M 5% .25W PC TC=-800/+900	01121	CB1055
A15R3	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R4	0698-0085 0	6	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R5	0698-0085 0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R6	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R7	0698-0085 0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R8	0698-0085 0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R9	0698-0085 0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R10	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R11	1810-0135 2	4	NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A15R12	1810-0055 5		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A15R13	1810-0135 2		NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A15R14	1810-0135 2		NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A15R15	1810-0055 5		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A15R16	1810-0055 5		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A15R17	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R18	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R19	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R20	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R21	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A15R22	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R23	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15TPCLK1	1251-4259 3	8	CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15TPCLK2	1251-4259 3		CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15TP81	1251-4259 3		CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15TP82	1251-4259 3		CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15TP83	1251-4259 3		CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15TP84	1251-4259 3		CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15TP85	1251-4259 3		CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15TP86	1251-4259 3		CONNECTOR-SGL CONT PIN .031-IN-BSC-BZ	28480	1251-4259
A15U1	1826-0331 3	1	IC V RGLTR TO-39	04713	XC79L12CG
A15U2	1820-1199 1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U3	1820-1123 1	1	IC MISC MOS	50088	MK5009N
A15U4	1820-1356 2	2	IC MV CMOS MONOSTBL RETRIG/RESET DUAL	04713	MC14528BCP
A15U5	1820-1199 1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U6	1820-1418 7	1	IC DCDR TTL LS BCD-TO-DEC 4-TO-10-LINE	01295	SN74LS42N
A15U7	1820-1480 3	1	IC MICPROC NMOS 8-BIT	04713	MC6800L
A15U8	1820-1918 2		IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS241N
A15U9	1820-1918 2		IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS241N
A15U10	1818-0135 8	3	IC MC 6810L-1 1K RAM NMOS	04713	MCM6810AL1
A15U11	1818-0135 8		IC MC 6810L-1 1K RAM NMOS	04713	MCM6810AL1
A15U12	1818-0135 8		IC MC 6810L-1 1K RAM NMOS	04713	MCM6810AL1
A15U13	1820-1202 7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A15U14	1820-1201 6	6	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A15U15	1820-1112 8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A15U16	1820-1298 1	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS251N
A15U17	1820-1637 2	1	IC MISC	04713	MC6870A
A15U18	1820-1216 3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A15U19	1820-0757 5		IC DRVR TTL L 8-BIT	28480	1820-0757
A15U20	1820-1197 9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A15U21	1820-1197 9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A15U22	1820-1693 0		IC LCH CMOS D-TYPE DUAL 4-BIT	04713	MC14508BCL
A15U23	1820-1693 0		IC LCH CMOS D-TYPE DUAL 4-BIT	04713	MC14508BCL
A15U25	1818-2701 8	1		28480	1818-2701
A15U26	1818-0395 2	1		28480	1818-0395
A15U27	1818-0396 3	1	IC ROM SCM 37219P	28480	1818-0396
A15U28	1818-0751 4	1	IC ROM MCM 37220P	28480	1818-0751
A15U29	1818-0398 5	1	IC ROM SCM 37221P	28480	1818-0398
A15U30	1818-0444 2	1	IC ROM SCM 37225P	28480	1818-0444
A15U31	1818-0400 0	1	IC ROM SCM 37223P	28480	1818-0400
A15U32	1820-1201 6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A15U33	1820-1491 6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A15U34	1826-0332 4	1	IC V RGLTR TO-39	04713	XC79L05CG
A15U35	1820-0634 7	1	IC CNTR MOS DECD	28480	1820-0634
A15U36	1820-1491 6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A15U37	1820-0702 0	2	IC DCDR TTL L 4-TO-16-LINE 4-INP	07263	93L11PC
A15U38	1820-1199 1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U39	1820-0702 0		IC DCDR TTL L 4-TO-16-LINE 4-INP	07263	93L11PC
A15U40	1820-1918 2		IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS241N
A15U41	1820-1244 7	1	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE	01295	SN74LS153N

Table 6-3. Replaceable Parts (22 of 51)

Reference Designation	HP Part Number		Qty	Description	Mfr Code	Mfr Part Number
A15U42	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A15U43	1826-0226	5	1	IC V RGLTR TO-39	07263	78M12HC
A15XJU5	1200-0473	3	3	SOCKET, IC, 16-CONT,DUAL INLINE TYPE	28480	1200-0473
A15XJU6	1200-0473	3		SOCKET, IC, 16-CONT,DUAL INLINE TYPE	28480	1200-0473
A15XJU7	1200-0473	3		SOCKET, IC, 16-CONT,DUAL INLINE TYPE	28480	1200-0473
A15XU7	1200-0552	4	2	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
A15XU10	1200-0565	9	12	SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A15XU11	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A15XU26	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A15XU27	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A15XU28	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A15XU29	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A15XU30	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A15XU31	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
MISC	0360-0124		7	SOLDER TERMINAL	28480	0360-0124
A16	04943-60016	8	1	HOLDING COIL & WEIGHTING FILTERS PC	28480	04943-60016
			1	BOARD ASSEMBLY		
A16C1	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A16C2	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C3	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A16C4	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C5	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A16C6	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A16C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C8	0160-2225	5		CAPACITOR-FXD 2000PF +-5% 300VDC MICA	28480	0160-2225
A16C9	0140-0163	4	4	CAPACITOR-FXD 4751PF +-1% 300VDC MICA	72136	DM20F475F0300WV1CR
A16C10	0140-0163	4		CAPACITOR-FXD 4751PF +-1% 300VDC MICA	72136	DM20F475F0300WV1CR
A16C11	0160-0218	2		CAPACITOR-FXD 2400PF +-1% 300VDC MICA	28480	0160-0218
A16C12	0160-3291	7		CAPACITOR-FXD 1200PF +-1% 100VDC MICA	28480	0160-3291
A16C13	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A16C14	0140-0163	4		CAPACITOR-FXD 4751PF +-1% 300VDC MICA	72136	DM20F475F0300WV1CR
A16C15	0140-0163	4		CAPACITOR-FXD 4751PF +-1% 300VDC MICA	72136	DM20F475F0300WV1CR
A16C16	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C17	0160-3024	4	6	CAPACITOR-FXD 1700PF +-1% 100VDC MICA	28480	0160-3024
A16C18	0160-3024	4		CAPACITOR-FXD 1700PF +-1% 100VDC MICA	28480	0160-3024
A16C19	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C20	0160-3024	4		CAPACITOR-FXD 1700PF +-1% 100VDC MICA	28480	0160-3024
A16C21	0160-3024	4		CAPACITOR-FXD 1700PF +-1% 100VDC MICA	28480	0160-3024
A16C22	0160-3024	4		CAPACITOR-FXD 1700PF +-1% 100VDC MICA	28480	0160-3024
A16C23	0160-3024	4		CAPACITOR-FXD 1700PF +-1% 100VDC MICA	28480	0160-3024
A16C24	0180-2206	4		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A16C25	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A16C26	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A16C27	0160-0576	5	21	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A16C28	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A16CR1	1902-0064	1		DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.09%	28480	1902-0064
A16CR2	1901-0029	6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR3	1901-0029	6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR4	1901-0029	6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR5	1901-0029	6		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16MP1	0403-0234	8		EXTRACTOR-PC BOARD BLK NYL .062-BD-THKNS	28480	0403-0234
A16MP2	1205-0085	8	2	HEAT SINK TO-66-PKG	28480	1205-0085
A16MP3	2360-0195	0		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A16MP4	2360-0195	0		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A16MP5	2360-0199	4		SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A16MP6	2420-0015	1		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A16MP7	2420-0015	1		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A16MP8	2420-0015	1		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A16Q1	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q4	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q6	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q7	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q8	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q9	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q10	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036

Table 6-3. Replaceable Parts (23 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16Q11	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q12	1854 0643 3		TRANSISTOR NPN	28480	1854 0643
A16Q13	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16R1	0757-0394 0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A16R2	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A16R3	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R4	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A16R5	0698-0084 9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A16R6	0757-0420 3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A16R7	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R8	0757-0200 7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A16R9	0698-6902 2	1	RESISTOR 34K .5% .125W F TC=0+-50	28480	0698-6902
A16R10	0698-0085 0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A16R11	2100-3154 7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A16R12	0698-8695 4	1	RESISTOR 36K .1% .125W F TC=0+-25	28480	0698-8695
A16R13	0698-7339 1	3	RESISTOR 72K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-7202-C
A16R14	0698-4339 5	1	RESISTOR 11.111K .1% .125W F TC=0+-50	28480	0698-4339
A16R15	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R16	0698-6423 2	2	RESISTOR 31.25K .1% .125W F TC=0+-25	28480	0698-6423
A16R17	0698-6423 2		RESISTOR 31.25K .1% .125W F TC=0+-25	28480	0698-6423
A16R18	0757-0444 1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A16R19	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R20	0698-0083 8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A16R21	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R22	0757-0346 2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A16R23	0757-0346 2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A16R24	0698-3451 0		RESISTOR 133K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1333-F
A16R25	0757-0463 4		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A16R26	0698-8696 5	2	RESISTOR 83.9K .1% .125W F TC=0+-25	28480	0698-8696
A16R27	0698-8696 5		RESISTOR 83.9K .1% .125W F TC=0+-25	28480	0698-8696
A16R28	0698-8697 6	1	RESISTOR 34.6K 1% .125W F TC=0+-100	28480	0698-8697
A16R29	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A16R30	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A16R31	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A16R32	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A16R33	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A16R34	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A16R35	0698-3452 1		RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A16R36	0698-3452 1		RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A16R37	0698-8162 0	1	RESISTOR 11.8K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-1182-C
A16R38	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R39	0698-7850 1	1	RESISTOR 9.455K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-9455R-B
A16R40	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A16R41	2100-3154 7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A16R42	0757-0274 5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A16R43	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A16R44	0698-3243 8		RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1783-F
A16R45	0698-3454 3		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A16R46	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A16R47	0698-3433 8		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A16R48	0698-7339 1		RESISTOR 72K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-7202-C
A16R49	0698-7339 1		RESISTOR 72K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-7202-C
A16R50	2100-3154 7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A16R51	0698-7376 6	1	RESISTOR 11.397K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-11397R-B
A16R52	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R53	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R54	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A16R55	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A16R56	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A16T1	9100-3822 1		XFMR-FERRITE: L=687UH:1KHZ	2484A	9100-3822
	9170-0554 9		COVER, TOROID MOD	28480	9170-0554
A16U1	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A16U2	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A16U3	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A16U4	1820-1807 8		IC 200 SWITCH TO-100	17856	DG200BA
A17	04943-60017 9	1	NOTCH FILTER & PROGRAMMABLE AMPLIFIER PC BOARD ASSEMBLY	28480	04943-60017
A17C1	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A17C2	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C3	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A17C4	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C5	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082

Table 6-3. Replaceable Parts (24 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17C6	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C7	0160-4136 1	2	CAPACITOR-FXD 3300PF +-1% 500VDC MICA	28480	0160-4136
A17C8	0160-3548 7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A17C9	0160-3879 7	6	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C10	0160-3879 7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C11	0160-3548 7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A17C12	0160-3548 7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A17C13	0160-4135 0	3	CAPACITOR-FXD 4700PF +-1% 300VDC MICA	28480	0160-4135
A17C14	0160-3879 7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C15	0160-3879 7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C16	0160-3548 7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A17C17	0160-3548 7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A17C18	0160-4136 1		CAPACITOR-FXD 3300PF +-1% 500VDC MICA	28480	0160-4136
A17C19	0160-3879 7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C20	0160-3879 7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C21	0160-3548 7		CAPACITOR-FXD .01UF +-1% 100VDC MICA	28480	0160-3548
A17C22	0160-0127 2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A17C23	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C24	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C25	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C26	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C27	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C28	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17CR1	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR2	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17J1	1200-0564 8		SOCKET-IC 8-CONT DIP-SLDR	28480	1200-0564
A17J2	1200-0568 6		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0568
A17J3	1251-3917 8	1	CONNECTOR 2-PIN M POST TYPE	28480	1251-3917
A17MP1	0403-0235 1		EXTRACTOR-PC BOARD BRN NYL .062-BD-THKNS	28480	0403-0235
A17R1	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R2	0757-0483 7	4	RESISTOR 511K 1% .125W F TC=0+-100	28480	0757-0483
A17R3	0698-6475 4		RESISTOR 19.1K 1% .125W F TC=0+-50	28480	0698-6475
A17R4	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A17R5	0698-6465 2	1	RESISTOR 11K 1% .125W F TC=0+-50	28480	0698-6465
A17R6	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A17R7	0698-6464 1	2	RESISTOR 8.06K 1% .125W F TC=0+-50	28480	0698-6464
A17R8	0698-6474 3	3	RESISTOR 19.6K 1% .125W F TC=0+-50	28480	0698-6474
A17R9	0698-6469 6	3	RESISTOR 5.11K 1% .125W F TC=0+-50	28480	0698-6469
A17R10	0698-3152 8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A17R11	0757-0444 1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A17R12	0698-6466 3	1	RESISTOR 14.7K 1% .125W F TC=0+-50	28480	0698-6466
A17R13	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A17R14	0698-6474 3		RESISTOR 19.6K 1% .125W F TC=0+-50	28480	0698-6474
A17R15	2100-3056 8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A17R16	0698-6467 8	1	RESISTOR 16.9K 1% .125W F TC=0+-50	27167	
A17R17	0698-6468 5	2	RESISTOR 51.1K 1% .125W F TC=0+-50	28480	0698-6468
A17R18	0698-6469 6		RESISTOR 5.11K 1% .125W F TC=0+-50	28480	0698-6469
A17R19	0698-3158 4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A17R20	0698-3162 0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A17R21	0698-6475 4		RESISTOR 19.1K 1% .125W F TC=0+-50	28480	0698-6475
A17R22	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A17R23	0757-0201 8	1	RESISTOR 6.81K 1% .125W F TC=0+-50	19701	MF4C1/8-T2-6811-F
A17R24	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A17R25	0698-6464 1		RESISTOR 8.06K 1% .125W F TC=0+-50	28480	0698-6464
A17R26	0698-6474 3		RESISTOR 19.6K 1% .125W F TC=0+-50	28480	0698-6474
A17R27	0698-6469 6		RESISTOR 5.11K 1% .125W F TC=0+-50	28480	0698-6469
A17R28	0698-3155 1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A17R29	0698-6478 3	1	RESISTOR 10.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1072-F
A17R30	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R31	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R32	1810-0223 9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A17R33	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R34	1810-0223 9		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0223
A17R35	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R36	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R37	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R38	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R42	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R43	1810-0262 5	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	28480	1810-0262
A17R44	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R45	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R46	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R47	0757-0444 9		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A17R48	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

Table 6-3. Replaceable Parts (25 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17R49	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R50	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A17R51	0698-4479 4	1	RESISTOR 14K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1402-F
A17R52	0698-6468 5		RESISTOR 51.1K 1% .125W F TC=0+-50	28480	0698-6468
A17R53	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R56-58	0698-7332 5	3	RESISTOR 1M 1% .125W	28480	0698-7332
A17R54	0757-0461 2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A17R55	2100-3056 8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A17TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A17TP2	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A17TP3	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A17TP4	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A17TP5	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A17U1	1826-0111 7		IC 1458 OP AMP TO-99	04713	MC1458G
A17U2	1826-0013 8	4	IC 741 OP AMP TO-99	06665	888741CJ
A17U3	1826-0111 7		IC 1458 OP AMP TO-99	04713	MC1458G
A17U4	1826-0013 8		IC 741 OP AMP TO-99	06665	888741CJ
A17U5	1826-0111 7		IC 1458 OP AMP TO-99	04713	MC1458G
A17U6	1826-0013 8		IC 741 OP AMP TO-99	06665	888741CJ
A17U7	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A17U8	1826-0429 0	1	IC MULTIPLXR 16-DIP-C	34371	MI1-1818A-5
A17U9	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A17U10	1820-1807 8		IC 200 SWITCH TO-100	17856	D02008A
A17U11	1826-0013 8		IC 741 OP AMP TO-99	06665	888741CJ
A17U12	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A17U13	1820-0944 2		IC GATE CMOS NOR TPL 3-INP	01928	CD4025AF
A17U14	04943-80002 4	1	ROM, 256 X 4	28480	04943-80002
A17U15	1820-1547 3		IC MUXR/DATA-SEL CMOS	04713	MC14051BCL
A17U16	1820-1693 0		IC LCH CMOS D-TYPE DUAL 4-BIT	04713	MC14508BCL
A17U17	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A17U18	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A17U19	1820-1807 8		IC 200 SWITCH TO-100	17856	D02008A
A17U20	1820-1547 3		IC MUXR/DATA-SEL CMOS	04713	MC14051BCL
A17U21	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A17W1	5060-7155 3	1	CABLE R.F. WITH CONN A6 THRU A17 CABLE ASSY	28480	5060-7155
A18	04943-60018 8	1	DETECTOR& & LOG QUANTIZER PC BOARD ASSY	28480	04943-60018
A18C1	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C2	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C3	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C4	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C5	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C6	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C7	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C8	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C9	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C10	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C11	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A18C12	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A18C13	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C14	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A18C15	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C16	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C17	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C18	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A18C19	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C20	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C21	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C22	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C23	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C24	0180-0291 3		CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2
A18C25	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C26	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C27	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A18C28	0160-3071 9		CAPACITOR-FXD 10μF +-10% 100 VDC POLYSTY	28480	0160-3071
A18C29	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A18CR1	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR2	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR3	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR4	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR5	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376

Table 6-3. Replaceable Parts (26 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18CR6	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR7	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR8	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR9	1901-0376 6		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR10	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A18CR11	1902-0064 1		DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	28480	1902-0064
A18CR12	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A18CR13	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A18J1	1200-0588 4	1	SOCKET-IC 16-CONT	28480	1200 0588
A18MP1	0403-0238 2		EXTRACTOR-PC BOARD RED NYL .062-BD-THKNS	28480	0403-0238
A18Q1	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A18Q2	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18R1	0757-0420 3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A18R2	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A18R3	0757-0420 3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A18R4	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R5	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R6	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A18R7	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A18R8	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A18R9	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A18R10	0757-0444 1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A18R11	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A18R12	0698-4475 0	1	RESISTOR 9.76K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-9761-F
A18R13	0698-3155 1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A18R14	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A18R15	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R16	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R17	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R18	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R19	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R20	0757-0288 1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A18R21	2100-3095 5	2	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	02111	43P201
A18R22	0757-0278 9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A18R23	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R24	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R25	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R26	0757-0401 0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R27	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R28	1810-0223 9		NETWORK-RES 8-PIN-8IP .1-PIN-SPCG	28480	1810-0223
A18R29	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A18R30	0683-1055 5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A18R31	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R32	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R33	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R34	0698-3153 9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A18R35	2100-3162 7	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 17-TRN	02111	43P204
A18R36	0698-3454 3		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A18R37	0698-4002 9		RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F
A18R38	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R39	0698-3152 8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A18R40	0757-0288 1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A18R41	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A18R42	2100-3103 6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A18R43	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R44	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R45	0698-3155 1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A18R46	0698-3150 6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A18R47	0757-0424 7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A18R48	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A18R49	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A18R50	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R51	0757-0123 9	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A18R52	0698-0083 8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A18R53	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R54	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R55	0757-0420 3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A18R56	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R57	0698-3151 7	4	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A18R58	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R59	2100-3123 0		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A18R60	0811-0125 1	1	RESISTOR 8.5435K .1% .25W PWW	50294	VA18-1/4-E-8543R5-B
A18R61	2100 3161 6	1	RESISTOR TRMR 20K 10% SIDE ADJ 17-TRW	0211	43P203

Table 6-3. Replaceable Parts (27 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18U1	1826-0309 5		IC OP AMP TO-99	24355	AD518J
A18U2	1820-1547 3		IC MUXR/DATA-SEL CMOS	04713	MC14051BCL
A18U3	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A18U4	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A18U5	1826-0183 3	2	IC COMPARATOR TO-100	07263	734MC
A18U6	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A18U7	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A18U8	1826-0183 3		IC COMPARATOR TO-100	07263	734MC
A18U9	1820-0944 2		IC GATE CMOS NOR TPL 3-INP	01928	CD4025AF
A18U10	1826-0065 0	3	IC 311 COMPARATOR 8-DIP-P	01295	SN72311P
A18U11	1820-0730 6	1	IC MV TTT LOW POWER MONO ASTBL	07263	96L02DC
A18U12	1820-1693 0		IC LCH CMOS D-TYPE DUAL 4-BIT	04713	MC14506BCL
A19	04943-60019 1	1	FREQUENCY TRACKING LOOP PC BOARD ASSY	28480	04943-60019
A19C1	0180-0141 2	2	CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A19C2	0180-0141 2		CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A19C3	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A19C4	0160-2216 4	2	CAPACITOR-FXD 820PF +-5% 300VDC MICA	28480	0160-2216
A19C5	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A19C6	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C7	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C8	0160-2216 4		CAPACITOR-FXD 820PF +-5% 300VDC MICA	28480	0160-2216
A19C9	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A19C10	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A19C11	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C12	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C13	0160-3902 7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A19C14	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C15	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C16	0160-2217 5	2	CAPACITOR-FXD 910PF +-5% 300VDC MICA	28480	0160-2217
A19C17	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C18	0160-2217 5		CAPACITOR-FXD 910PF +-5% 300VDC MICA	28480	0160-2217
A19C19	0160-3902 7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A19C20	0160-3902 7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A19C21	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C22	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C23	0160-3902 7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A19C24	0160-3902 7		CAPACITOR-FXD .1UF +-10% 200VDC POLYC	28480	0160-3902
A19C25	0160-3510 3		CAPACITOR-FXD 3UF +-10% 50VDC MET-POLYC	28480	0160-3510
A19C26	0160-3071 1		CAPACITOR-FXD 10UF +-10% 100VDC	01448	17UB106K
A19C27	0180-0291 3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A19C28	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C29	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C30	0160-2723 8	1	CAPACITOR-FXD 3900PF +-2% 500VDC MICA	28480	0160-2723
A19C31	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A19C32	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A19C33	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C34	0180-0291 3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A19C35	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C36	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A19C37	0160-2259 5	1	CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A19CR1	1902-3036 3	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A19CR2	1902-3036 3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A19CR3	1902-3182 0	1	DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	28480	1902-3182
A19CR4	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR5	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR6	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR7	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR8	1902-3114 8	1	DIODE-ZNR 6.19V 2% DO-7 PD=.4W TC=+.022%	28480	1902-3114
A19CR9	1902-3082 9	3	DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A19JU1	1251-3720 1		CONNECTOR-SGL CONT SKT .04-IN-SQ-BSC-SZ RND	28480	1251-3720
A19JU2	0360-0124 3	53	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
	1251-3720 1		CONNECTOR-SGL CONT SKT .04-IN-SQ-BSC-SZ RND	28480	1251-3720
	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19MP1	0403-0236 0		EXTRACTOR-PC BOARD ORN NYL .062-BD-THKNS	28480	0403-0236
A19Q1	1853-0036 2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A19Q2	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19Q3	1854-0019 3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A19Q4	1855-0078 6		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0078
A19Q5	1855-0082 2	1	TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A19Q6	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19Q7	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19Q8	1854-0019 3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019

Table 6-3. Replaceable Parts (28 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A19R1	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R2	0757-0459 8		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A19R3	0757-0470 3		RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A19R4	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R5	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R6	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R7	0698-3156 2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R8	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R9	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R10	0757-1094 9	4	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A19R11	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R12	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A19R13	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R14	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R15	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R16	0698-3440 7	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A19R17	0698-3440 7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A19R18	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A19R19	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A19R20	0757-0460 1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A19R21	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R22	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R23	2100-3161 6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A19R24	0757-0463 4		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A19R25	0757-0464 5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A19R26	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R27	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R28	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R29	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R30	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R31	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R32	0698-3455 7	2	RESISTOR 261K 1% .125W F TC=0+-100	28480	0698-3455
A19R33	0698-3455 7		RESISTOR 261K 1% .125W F TC=0+-100	28480	0698-3455
A19R34	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R35	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R36	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A19R37	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R38	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R39	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R40	0683-2055 7		RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A19R41	0698-3453 2		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A19R42	0683-2055 7		RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A19R43	0683-2055 7		RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A19R44	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R45	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R46	0698-3152 8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A19R47	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R48	0698-3447 4	4	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A19R49	0757-1094 9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A19R50	0698-3447 4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A19R51	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R52	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A19R53	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R54	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R55	0757-0482 7		RESISTOR 511K 1% .125W F TC=0+-100	28480	0757-0482
A19R56	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A19R57	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R58	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R59	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A19R60	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A19TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP2	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP3	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP4	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP5	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP6	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP7	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP8	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP9	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP10	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP11	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19U1	1826-0321 1		IC COMPARATOR 14-DIP-P	01928	CA3099E
A19U2	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A19U3	1820-0938 4		IC FF CMOS J-K M/S POS-EDGE-TRIG DUAL	01928	CD4027AE
A19U4	1820-0947 5	1	IC GATE CMOS EXCL-OR QUAD 2-INP	01928	CD4030AE
A19U5	1820-1932 0	1	IC MV CMOS MONOSTBL RETRIG/RESET DUAL	04713	MC14538BCP

Table 6-3. Replaceable Parts (29 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A19U6	1820-1932 2		IC MV CMOS MONOSTBL RETRIG/RESET DUAL	04713	MC14538BCP
A19U7	1820-0049 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A19U8	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A19U9	1826-0275 4	2	IC 78L12A V RGLTR TO-92	04713	78L12ACP
A19U10	1826-0180 0		IC 555 8-DIP-P	18324	NE555V
A19U11	1820-1328 8		IC CNTR CMOS BIN 4-BIT	04713	MC14520CP
A19U12	1826-0003 6	2	IC 1456 OP AMP TO-99	04713	MC1456CG
A19U13	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A19U14	1820-1807 8		IC 200 SWITCH TO-100	17856	DG200BA
A19U15	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A20	04943-60020 4	1	ANALOG OUTPUT ASSEMBLY	28480	04943-60020
A20C1	0180-0374 3	5	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C2			NOT ASSIGNED		
A20C3	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C4			NOT ASSIGNED		
A20C5	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C6			NOT ASSIGNED		
A20C7	0160-0576 5	23	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C8	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C9	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C10	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C11	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C12	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C13	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C14	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C15	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C16	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C17	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C18	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C19	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C20	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C21	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C22	0160-2201 7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A20C23	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C24	0160-2218 6	1	CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A20C25	0180-0228 6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A20C26	0160-4137 2	1	CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A20C27	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C28	0160-2211 9	1	CAPACITOR-FXD 510PF +-5% 300VDC MICA	28480	0160-2211
A20C29	0160-2204 0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A20C30	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C31	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C32			NOT ASSIGNED		
A20C33			NOT ASSIGNED		
A20C34	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C35	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C36	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C37	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C38	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C39	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20CR1	1901-0040 1	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20CR2	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20J1	1251-4399 2	2	CONNECTOR 8-PIN M POST TYPE	28480	1251-4399
A20J2	1251-4399 2		CONNECTOR 8-PIN M POST TYPE	28480	1251-4399
A20MP1	0403-0239 3	2	EXTRACTOR-PC BOARD YEL NYL .062-BD-THKNS	28480	0403-0239
A20MP2	0403-0239 3		EXTRACTOR-PC BOARD YEL NYL .062-BD-THKNS	28480	0403-0239
A20Q1	1854-0071 7	2	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A20Q2	1855-0286 8	1	TRANSISTOR N-CHANNEL J-FET 2N3966	28480	1855-0286
A20Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A20R1	0757-0280 3	8	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R2	0757-0279 0	3	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R3	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R4	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R5	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R6	0757-0442 9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R7	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R8	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R9	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R10	0757-0438 3	6	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R11	0698-3157 3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A20R12	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R13	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R14	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R15	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R16	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R17	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R18	0698-3243 8	2	RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1783-F
A20R19	0698-3243 8		RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1783-F
A20R20	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

Table 6-3. Replaceable Parts (30 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20R21	0757-0438	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R22			NOT ASSIGNED		
A20R23	1810-0135	2	NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0269
A20R24	1810-0135	2	NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A20R25	1810-0269	3	NETWORK-RES 9-PIN-SIP .1-PIN-SPCG	28480	1810-0269
A20R26	0757-0279	0	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R27	0757-0443	0	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A20R28	0757-043A	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20TP1	1251-4259	3	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-4259
A20TP2	1251-4259	3	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-4259
A20TP3	1251-4259	3	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-4259
A20TP(N)	1251-4259		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-4259
A20U1	1818-0342	9	IC NMOS 1K RAM STAT 450-NS 3-S	34649	P2101A-4
A20U2	1818-0342	9	IC NMOS 1K RAM STAT 450-NS 3-S	34649	P2101A-4
A20U3	1820-2096	9	IC CNTR TTL LS BIN DUAL 4-BIT	01295	SN74LS393N
A20U4	1820-1461	0	IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74273
A20U5	1820-1461	0	IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74273
A20U6	1820-1195	7	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A20U7	1820-1201	6	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A20U8	1820-1419	8	IC COMPTR TTL LS MAGTD 4-BIT	01295	SN74LS85N
A20U9	1820-1419	8	IC COMPTR TTL LS MAGTD 4-BIT	01295	SN74LS85N
A20U10	1820-2096	9	IC CNTR TTL LS BIN DUAL 4-BIT	01295	SN74LS393N
A20U11	1820-1461	0	IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74273
A20U12	1820-1918	2	IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS241N
A20U13	1820-1491	6	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A20U14	04943-80003	5	ROM, 128 X 8	28480	04943-80003
A20U15	1820-1203	8	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A20U16	1820-1197	9	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A20U17	1820-1208	3	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A20U18	1820-1251	6	IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A20U19	1820-1437	0	IC MV TTL LS MONOSTBL DUAL	01295	SN74LS221N
A20U20	1826-0065	0	IC 311 COMPARATOR 8-DIP-P	01295	SN72311P
A20U21	1826-0208	3	IC OP AMP 8-DIP-P	27014	LM310N
A20U22	1826-0430	3	IC CONV 16-DIP-C	24355	AD559KD
A20U23	1826-0430	3	IC CONV 16-DIP-C	24355	AD559KD
A20U24	1826-0430	3	IC CONV 16-DIP-C	24355	AD559KD
A20U25	1826-0089	8	IC 2525 OP AMP TO-99	29832	1322
A20U26	1826-0319	7	IC OP AMP TO-99	27014	LF356H
A20U27	1826-0237	8	IC 14-DIP-P	52063	XR320
A21	04942-60021	4	MP-IB PC BOARD ASSEMBLY (OPTION 010)	28480	04942-60021
A21C1	0160-2145	8	CAPACITOR-FXD 5000PF +80-20% 100VDC CER	28480	0160-2145
A21C2	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C3	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C4	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C5	0160-2145	8	CAPACITOR-FXD 5000PF +80-20% 100VDC CER	28480	0160-2145
A21C6	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C7	0180-0374	3	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A21C8	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C9	0180-0374	3	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A21C10	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C11	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C12	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A21C13	0180-0374	3	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A21J1	1251-4058	0	CONNECTOR 26-PIN M RECTANGULAR	28480	1251-4058
A21J2	1200-0588	6	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0588
A21MP1	0403-0237	1	EXTRACTOR-PC BOARD GRN NYL .062-BD-THKNS	28480	0403-0237
A21R1	0757-0403	2	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A21R2	0698-3452	1	RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A21R3	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R4	1810-0055	5	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A21R5	1810-0135	2	NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A21R6	0757-0403	2	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A21R7	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R8	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R9	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

Table 6-3. Replaceable Parts (31 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2181	3101-1826 9	1	SWITCH-TGL DIP-RKR-ASSY 7-1A NS .1A 5VDC	28480	3101-1826
A21U1	1826-0275 4		IC 78L12A V RGLTR TO-92	04713	78L12ACP
A21U2	1820-0904 4	1	IC COMPTR TTL L MAGTD 5-BIT	07263	93L24PC
A21U3	1820-1689 4	4	IC MISC QUAD	04713	MC3446P
A21U4	1820-1689 4		IC MISC QUAD	04713	MC3446P
A21U5	1820-1689 4		IC MISC QUAD	04713	MC3446P
A21U6	1820-1689 4		IC MISC QUAD	04713	MC3446P
A21U7	1820-1481 4	1	IC PIA NMOS	04713	MC6820L
A21U8	1820-0757 5		IC DRVR TTL L 8-BIT	28480	1820-0757
A21U9	1820-1199 1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A21U10	1820-1201 6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A21U11	1820-1200 5	1	IC INV TTL LS HEX	01295	SN74LS05N
A21U12	1818-2275 1	1	IC, ROM, 512 x 8	28480	1818-2275
A21U13	1820-1201 6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A21U14	1820-1112 8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A21U15	1820-1208 3		IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A21U16	1820-1201 6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A21U17	1820-1203 8		IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A21U18	1820-1212 9	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112N
A21U19	1820-1197 9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A21U20	1820-1197 9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A21U21	1820-1203 8		IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A21U22	1820-1112 8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A21U23	1820-0708 6	1	IC MUXR/DATA-SEL TTL L 4-TO-1-LINE DUAL	07263	93L09PC
A21XU7	1200-0552 4		SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
A21XU12	1200-0565 9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A22	04943-60022 6	1	PHASE JITTER PC BOARD ASSEMBLY	28480	04943-60022
A22BP1	0340-0060 4		TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	28480	0340-0060
A22C1	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A22C2	0160-3094 8	3	CAPACITOR-FXD .1UF +-10% 100VDC CER	28480	0160-3094
A22C3	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A22C4	0160-3094 8		CAPACITOR-FXD .1UF +-10% 100VDC CER	28480	0160-3094
A22C5	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A22C6	0160-3094 8		CAPACITOR-FXD .1UF +-10% 100VDC CER	28480	0160-3094
A22C7	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C8	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C9	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C10	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C11	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A22C12	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A22C13	0160-2387 0	1	CAPACITOR-FXD 1000PF +-1% 500VDC MICA	28480	0160-2387
A22C14	0180-2206 4		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A22C15	0180-2206 4		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A22C16	0160-0153 4	1	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A22C17	0170-0040 9	1	CAPACITOR-FXD .047UF +-10% 200VDC POLYE	56289	292P47392
A22C18	0160-3645 5	1	CAPACITOR-FXD 1UF +-1% 100VDC MET-POLYE	84411	X663F10511M2
A22C19	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A22C20	0180-0094 4	4	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A22C21	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C22	0180-0094 4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A22C23	0160-4135 0		CAPACITOR-FXD 4700PF +-1% 300VDC MICA	28480	0160-4135
A22C24	0160-4135 0		CAPACITOR-FXD 4700PF +-1% 300VDC MICA	28480	0160-4135
A22C25	0160-0943 0		CAPACITOR-FXD .03UF +-1% 100VDC MICA	28480	0160-0943
A22C26	0160-0943 0		CAPACITOR-FXD .03UF +-1% 100VDC MICA	28480	0160-0943
A22C27	0160-0943 0		CAPACITOR-FXD .03UF +-1% 100VDC MICA	28480	0160-0943
A22C28	0140-0184 9	2	CAPACITOR-FXD 8200PF +-1% 100VDC MICA	72136	DM20F822F0100WV1CR
A22C29	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A22C30	0140-0184 9		CAPACITOR-FXD 8200PF +-1% 100VDC MICA	72136	DM20F822F0100WV1CR
A22C31	0160-2253 9	2	CAPACITOR-FXD 6.8PF +-.25PF 500VDC CER	28480	0160-2253
A22C32	0160-0127 2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A22C33	0160-0127 2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A22C34	0160-2253 9		CAPACITOR-FXD 6.8PF +-.25PF 500VDC CER	28480	0160-2253
A22C35	0150-0121 5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A22C36	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A22C37	0160-0136 3	1	CAPACITOR-FXD 2500PF +-1% 300VDC MICA	28480	0160-0136
A22CR1	1902-3082 9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A22CR2	1902-3082 9		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A22CR3	1901-0179 7	2	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A22CR4	1901-0179 7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A22CR5	1902-0052 7	1	DIODE-ZNR 6.81V 2% DO-7 PD=.4W TC=+.043%	28480	1902-0052

Table 6-3. Replaceable Parts (32 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22CR6	1901-0033	4	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A22CR7	1901-0033	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A22CR8	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR9	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR10	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR11	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR12	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR13	1902-0025	4	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A22CR14	1901-0033	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A22CR15	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR16	1901-0040	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR17	1901-0033	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A22MP1	0403-0240	6	EXTRACTOR-PC BOARD BLU NYL .062-BD-THKNS	28480	0403-0240
A22Q1	1853-0036	2	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A22Q2	1855-0052	6 1	TRANSISTOR J-FET P-CHAN D-MODE TO-92 SI	07263	2N4360
A22Q3	1855-0062	8	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A22R1	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R2	0698-3151	7	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A22R3	0757-0141	5 1	RESISTOR 10.1K 1% .25W F TC=0+-100	19701	MF52C1/4-T0-1012-F
A22R4	0698-3159	5	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A22R5	0698-6360	6	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R6	0698-6360	6	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R7	0698-7679	2 1	RESISTOR 19.41K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-19411-B
A22R8	0698-0077	0 1	RESISTOR 93.1K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-9312-F
A22R9	0698-0083	8	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A22R10	0698-7419	8 1	RESISTOR 3.57K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-3571-C
A22R11	0698-4198	4 1	RESISTOR 1.174K 1% .25W F TC=0+-100	27167	C5-1/4-T0-1174R-F
A22R12	0698-8462	1 1	RESISTOR 290.5	24602	MR1-1-1/2-T00-5004-K
A22R13	0757-0886	5 1	RESISTOR 23.2K 1% .25W F TC=0+-100	27167	C5-1/4-T0-2322-F
A22R14	0698-8310	0 1	RESISTOR 472K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-4723-B
A22R15	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R16	0757-0401	0	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R17	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R18	0757-0401	0	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R19	0757-0440	7	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A22R20	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A22R21	0698-3151	7	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A22R22	0698-3151	7	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A22R23	0757-0443	0	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A22R24	0757-0290	5	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R25	0757-0401	0	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R26	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R27	0757-0401	0	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R28	2100-3154	7	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A22R29	0757-0458	7	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A22R30	0757-0416	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R31	0757-0458	7	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A22R32	0757-0416	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R33	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A22R34	0698-7360	8 1	RESISTOR 398.5K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-39852-B
A22R35	0757-0447	4	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A22R36	0698-6360	6	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R37	0698-6360	6	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R38	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R39	0698-3447	4	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A22R40	0698-3430	5 2	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A22R41	0698-7989	7 1	RESISTOR 19.6K .5% .125W F TC=0+-25	19701	MF4C1/8-T9-1962-D
A22R42	0698-3447	4	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A22R43	0698-3430	5	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A22R44	0757-0439	4	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A22R45	0757-0199	3	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R46	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A22R47	0698-3160	8	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A22R48	0757-1094	9	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A22R49	0698-3160	8	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A22R50	0698-6348	0	RESISTOR 3K .1% .125W F TC=0+-25	28480	0698-6348
A22R51	0757-0464	5	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A22R52	2100-3103	6	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A22R53	0757-0290	5	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R54	0757-0465	6	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R55	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A22R56	0757-0465	6	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R57	0698-3167	5 1	RESISTOR 25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2502-F
A22R58	0698-0064	5 1	RESISTOR 9.31K 1% .125W F TC=0+-100	91637	CMF-1/8-T1-9311-F
A22R59	0698-6360	6	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R60	0698-6360	6	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360

Table 6-3. Replaceable Parts (33 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22R61	0757-0462 3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A22R62	0698-6360 6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R63	0757-0447 4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A22R64	2100-3056 8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A22R65	0757-0459 8		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A22R66	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R67	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R68	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R69	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R70	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R71	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R72	1810-0312 7	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0312
A22R73	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R74	0698-3161 9		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A22R75	0757-0416 7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R76	0698-6332 2	1	RESISTOR 300K .1% .125W F TC=0+-25	28480	0698-6332
A22R77	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R78	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22TP2	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22TP3	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22U1	1821-0001 4		TRANSISTOR ARRAY	01928	CA3046
A22U2	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U3	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U4	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U5	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U6	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U7	1826-0065 0		IC 311 COMPARATOR 8-DIP-P	01295	SN72311P
A22U8	1826-0208 3		IC OP AMP 8-DIP-P	27014	LM310N
A22U9	1826-0138 8	1	IC COMPARATOR 14-DIP-P	27014	LM339N
A22U10	1820-1807 8		IC 200 SWITCH TO-100	17856	DG200BA
A22U11	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U12	1820-1496 1	1	IC FF CMOS J-K M/S POS-EDGE-TRIG DUAL	04713	MC14027CP
A22U13	1826-0180 0		IC 555 8-DIP-P	18324	NE555V
A22U14	1826-0003 6		IC 1456 OP AMP TO-99	04713	MC1456CG
A22U15	1820-1536 0	1	IC GATE CMOS EXCL-OR QUAD 2-INP	01928	CD4030AF
A22U16	1820-1317 5		IC MV CMOS MONO/ASTBL	01928	CD4047AE
A22U17	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U18	1820-1385 7	1	IC BFR CMOS INV HEX 1-INP	04713	MC14502CP
A22U19	1820-0949 7		IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF

Table 6-3. Replaceable Parts (34 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22	04944-60022 7	1	NLD TRMTER PC BOARD ASSEMBLY (OPTION 012)	28480	04944-60022
A22C1	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A22C2	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A22C3	0180-1746 5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A22C4	0160-2198 1	4	CAPACITOR-FXD 20PF +-5% 300VDC MICA	28480	0160-2198
A22C5	0140-0194 1	5	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A22C6	0160-2198 1		CAPACITOR-FXD 20PF +-5% 300VDC MICA	28480	0160-2198
A22C7	0140-0194 1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A22C8	0160-2198 1		CAPACITOR-FXD 20PF +-5% 300VDC MICA	28480	0160-2198
A22C9	0140-0194 1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A22C10	0160-2198 1		CAPACITOR-FXD 20PF +-5% 300VDC MICA	28480	0160-2198
A22C11	0140-0194 1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A22C12	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A22C13	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A22C14	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C15	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C16	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22C17	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22C18	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C19	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A22C20	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22C21	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22C22	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22C23	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22C24	0180-0291 3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22C25	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A22C26	0180-0291 3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22C27	0180-2206 4		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X900682
A22C28	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22C29	0180-0291 3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22C30	0160-4397 6		CAPACITOR-FXD .1UF +-1% 100VDC POLYSTY	28480	0160-4397
A22C31	0180-0373 2	1	CAPACITOR-FXD .68UF+-10% 35VDC TA	56289	150D684X9035A2
A22C32	0180-2206 4		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X900682
A22C33	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A22MP1	0403-0240 6		EXTRACTOR-PC BOARD BLU NYL .062-BD-THKNS	28480	0403-0240
A22R1	0683-2265 1		RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A22R2	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R3	0683-2265 1		RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A22R4	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R5	0683-2265 1		RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A22R6	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R7	0683-2265 1		RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A22R8	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R9	1810-0225 1		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0225
A22R10	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A22R11	1810-0225 1		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0225
A22R12	1810-0225 1		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0225
A22R13	0757-0289 2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A22R14	1810-0225 1		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0225
A22R15	0757-0290 5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R16	0757-0444 1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A22R17	0757-0123 3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A22R18	0757-0123 3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A22R19	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R20	0757-0458 7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A22R21	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R22	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R23	0757-0449 6	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A22R24	0757-0123 3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A22R25	0757-0123 3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A22R26	0757-0199 3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R27	2100-3056 8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A22R28	0757-0443 0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A22R29	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R30	0757-1094 9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A22R31	0757-0417 8	1	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A22R32	2100-3109 2		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A22R33	0757-0439 4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A22R34	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R35	0757-0403 2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F

Table 6-3. Replaceable Parts (35 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22TP2	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22TP3	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22TP4	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22TP5	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22TP6	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A22U1	1820-1592 8	1	IC INV CMOS HEX 1-INP	04713	MC14069BCL
A22U2	1820-2054 9	4	IC CNTR CMOS BIN ASYNCHRO NEG-EDGE-TRIG	04713	MC14040BCL
A22U3	1820-1199 1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A22U4	1820-2054 9		IC CNTR CMOS BIN ASYNCHRO NEG-EDGE-TRIG	04713	MC14040BCL
A22U5	1826-0219 6	2	IC 567 8-DIP-P	18324	NE567V
A22U6	1820-2054 9		IC CNTR CMOS BIN ASYNCHRO NEG-EDGE-TRIG	04713	MC14040BCL
A22U7	1820-2055 0	4	IC SHF-RGTR CMOS ASYNCHRO POS-EDGE-TRIG	04713	MC14015BCL
A22U8	1820-2054 9		IC CNTR CMOS BIN ASYNCHRO NEG-EDGE-TRIG	04713	MC14040BCL
A22U9	1820-2055 0		IC SHF-RGTR CMOS ASYNCHRO POS-EDGE-TRIG	04713	MC14015BCL
A22U10	1820-2055 0		IC SHF-RGTR CMOS ASYNCHRO POS-EDGE-TRIG	04713	MC14015BCL
A22U11	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U12	1820-2055 0		IC SHF-RGTR CMOS ASYNCHRO POS-EDGE-TRIG	04713	MC14015BCL
A22U13	1820-0493 6		IC OP AMP 8-DIP-P	27014	LM307N
A22U14	1820-1807 8		IC 200 SWITCH TO-100	17856	DG200BA
A22U15	1820-1693 0		IC LCH CMOS D-TYPE DUAL 4-BIT	04713	MC14508BCL
A22U16	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558N8
A22U17	1826-0219 6		IC 567 8-DIP-P	18324	NE567V
A22Y1	0410-1110 6	1	CRYSTAL, QUARTZ 175616 HZ	28480	0410-1110
A22Y2	0410-1111 7	1	CRYSTAL, QUARTZ 177664 HZ	28480	0410-1111
A22Y3	0410-1112 8	1	CRYSTAL, QUARTZ 219392 HZ	28480	0410-1112
A22Y4	0410-1113 9	1	CRYSTAL, QUARTZ 220928 HZ	28480	0410-1113

Table 6-3. Replaceable Parts (36 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23	04942-60023 6	1	POWER SUPPLY PC BOARD ASSEMBLY	28480	04942-60023
A23C1	0180-2629 5	1	CAPACITOR-FXD .01F+75-10% 16VDC AL	56289	43D103G016LP1
A23C2	0180-2082 4	2	CAPACITOR-FXD 4000UF+75-10% 25VDC AL	56289	39D408G025J94
A23C3	0180-2082 4		CAPACITOR-FXD 4000UF+75-10% 25VDC AL	56289	39D408G025J94
A23C4	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A23C5	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A23C6	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C7	0180-0104 7		CAPACITOR-FXD 200UF+75-10% 16VDC AL	56289	30D207G016DF2
A23C8	0180-0094 4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A23C9	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A23C10	0180-0104 7		CAPACITOR-FXD 200UF+75-10% 16VDC AL	56289	30D207G016DF2
A23C11	0180-0104 7		CAPACITOR-FXD 200UF+75-10% 16VDC AL	56289	30D207G016DF2
A23C12	0160-3060 8	3	CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A23C13	0160-3060 8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A23C14	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A23C15	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A23C16	0160-3060 8		CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-3060
A23C17	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A23C18	0160-3451 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A23C19	0180-0094 4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A23C20	0160-0128 3	3	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A23C21	0160-0128 3		CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A23C22	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C23	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C24	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C25	0160-0128 3		CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A23C26	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23CR1	1901-0754 4	4	DIODE-PWR RECT 50V 5A SU8	03508	A15F
A23CR2	1901-0754 4		DIODE-PWR RECT 50V 5A SU8	03508	A15F
A23CR3	1901-0754 4		DIODE-PWR RECT 50V 5A SU8	03508	A15F
A23CR4	1901-0754 4		DIODE-PWR RECT 50V 5A SU8	03508	A15F
A23CR5	1901-0363 1	2	DIODE-FW BRDG 100V 1A	28480	1901-0363
A23CR6	1901-0363 1		DIODE-FW BRDG 100V 1A	28480	1901-0363
A23CR7	1902-0692 1	1	DIODE-ZNR 6.3V 1% DO-7 PD=.4W TC=+.001%	28480	1902-0692
A23CR8	1884-0250 7	3	THYRISTOR-TRIAC TO-220AB	01928	T2500B
A23CR9	1884-0250 7		THYRISTOR-TRIAC TO-220AB	01928	T2500B
A23CR10	1884-0250 7		THYRISTOR-TRIAC TO-220AB	01928	T2500B
A23CR11	1902-0202 W	1	DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A23CR12	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR13	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR14	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR15	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR16	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23J1	1251-4271 9	1	CONNECTOR 10-PIN M UTILITY	28480	1251-4271
A23JU1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A23JU1	1251-3720 1		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-3720
A23MP1	2360-0193 8	1	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A23MP2	2420-0015 1		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A23Q1	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A23Q2	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A23Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A23R1	0757-0814 9	1	RESISTOR 511 1% .5W F TC=0+-100	28480	0757-0814
A23R2	0757-0346 2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A23R3	0698-3410 1	2	RESISTOR 3.16K 1% .5W F TC=0+-100	28480	0698-3410
A23R4	0757-0346 2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A23R5	0698-3410 1		RESISTOR 3.16K 1% .5W F TC=0+-100	28480	0698-3410
A23R6	0757-0346 2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A23R7	0757-0418 9	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A23R8	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R9	0698-8463 4	2	RESISTOR 464.2 .1% .125W F TC=0+-25	28480	0698-8463
A23R10	0698-8463 4		RESISTOR 464.2 .1% .125W F TC=0+-25	28480	0698-8463
A23R11	0698-7870 5	1	RESISTOR 1.59K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-1591-C
A23R12	0698-7862 5	1	RESISTOR 9.9K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-9901-C
A23R13	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R14	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R15	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R16	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R17	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R18	0698-3540 8	2	RESISTOR 15.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1542-F
A23R19	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R20	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

Table 6-3. Replaceable Parts (37 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23R21	0698-3540 8		RESISTOR 15.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1542-F
A23R22	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R23	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R24	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R25	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R26	0757-0439 4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A23R27	2100-3154 7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A23R28	0757-0441 8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A23R29	0757-0439 4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A23R30	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R31	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R32	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R33	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R34	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R35	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R36	0757-0288 1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A23R37	2100-3154 7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A23R38	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R39	0698-3166 4	2	RESISTOR 6.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6481-F
A23R40	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R41	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R42	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R43	0757-0288 1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A23R44	2100-3154 7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A23R45	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R46	0698-3166 4		RESISTOR 6.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6481-F
A23R47	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R48	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R49	0698-3450 9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23U1			NOT ASSIGNED		
A23U2	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558NB
A23U3	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558NB
A23U4	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558NB
A23U5	1826-0328 8		IC 4558 OP AMP 8-DIP-P	07933	RV4558NB
			4943A MISCELLANEOUS		
	9211-2422 2	1	CARTON-CORR R&C 18-IN-LG 15.25-IN-WD	28480	9211-2422
	9211-2423 3	1	CARTON-CORR FLT 13.25-IN-LG 10.25-IN-WD	28480	9211-2423
	9220-2562 0	1	PAD-CORR RTRP 13.125LG 10.375WD	28480	9220-2562
	04943-90001 4	1	MANUAL-OPERATING INSTRUCTIONS	28480	04943-90001
	7124-2083	1	LABEL, YELLOW WARNING	28480	7124-2083
	9320-2407	1	ENVELOPE, 120V, FUSE		

Table 6-3. Replaceable Parts (38 of 51)

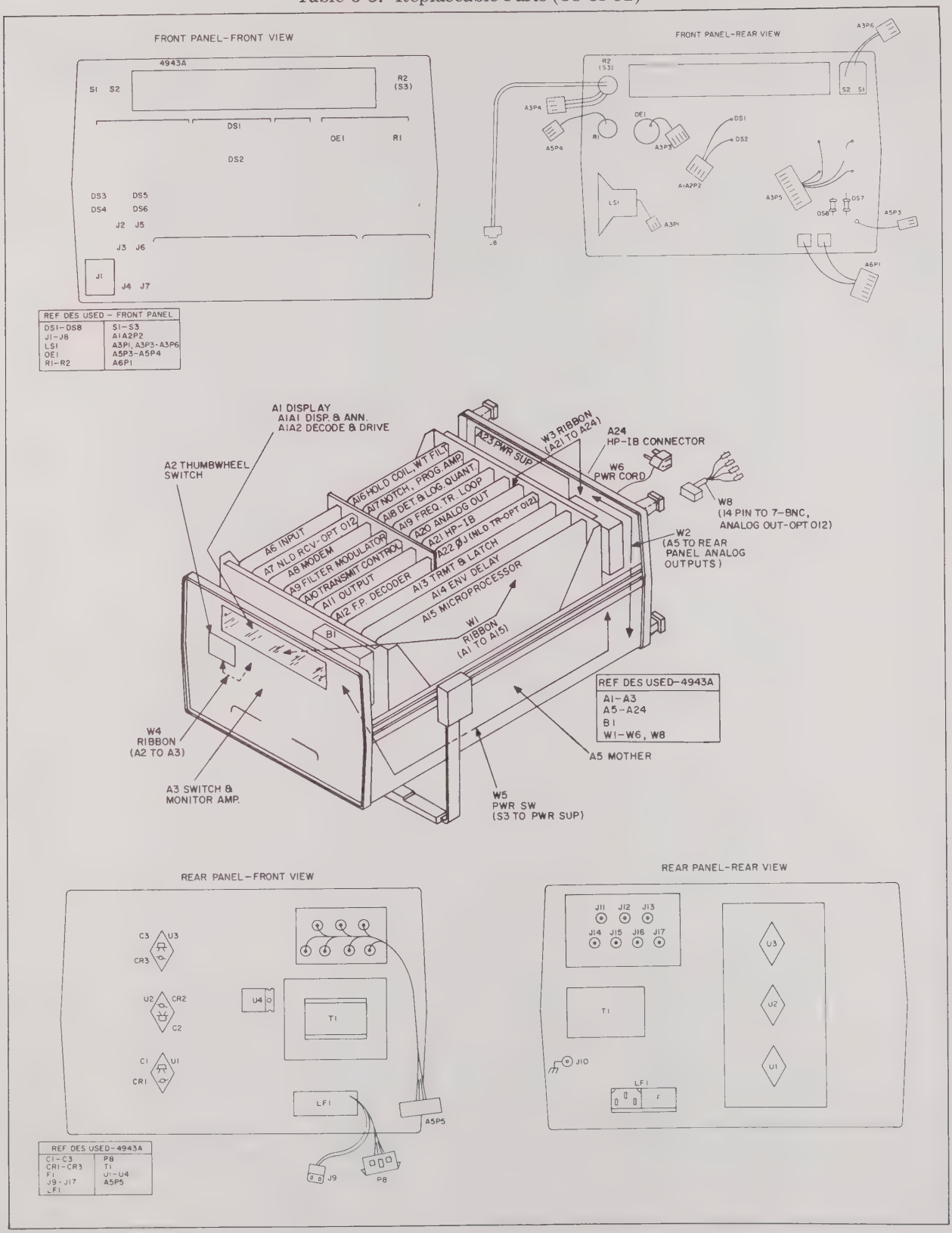


Table 6-3. Replaceable Parts (39 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS MOUNTED ELECTRICAL COMPONENTS		
A1A2P2	1251-4730 5	1	CONNECTOR 4-PIN F POST TYPE	28480	1251-4730
A1A2P2	1251-4551 8	4	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P1	1251-4732 7	1	CONNECTOR 2-PIN F POST TYPE	28480	1251-4732
A3P1	1251-4551 8	2	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P3	1251-4551 8	4	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P3	1251-4730 5	1	CONNECTOR 4-PIN F POST TYPE	28480	1251-4730
A3P4	1251-4829 3	1	CONNECTOR 3-PIN F POST TYPE	28480	1251-4829
A3P4	1251-4551 8	3	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P5	1251-4731 6	1	CONNECTOR 8-PIN F POST TYPE	28480	1251-4731
A3P5	1251-4551 8	8	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A3P6	1251-4829 3	1	CONNECTOR 3-PIN F POST TYPE	28480	1251-4829
A3P6	1251-4551 8	3	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A5P3	1251-4732 7	1	CONNECTOR 2-PIN F POST TYPE	28480	1251-4732
A5P3	1251-4551 8	2	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A5P4	1251-4829 3	1	CONNECTOR 3-PIN F POST TYPE	28480	1251-4829
A5P4	1251-4551 8	3	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A5P5	1251-4731 6	1	CONNECTOR 8-PIN F POST TYPE	28480	1251-4731
A5P5	1251-4551 8	8	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
A6P1	1251-4728 1	1	CONNECTOR 6-PIN F POST TYPE	28480	1251-4728
A6P1	1251-4551 8	6	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
B1	3160-0297 0	1	FAN-TBAX 19-CFM 115V 50/60-HZ .084-AMP	28480	3160-0297
C1	0160-0174 9	6	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
C2	0160-0174 9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
C3	0160-0174 9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
CR1	1901-0696 3	6	DIODE-PWR RECT 400V 2A 200NS	03508	A114D
CR2	1901-0696 3		DIODE-PWR RECT 400V 2A 200NS	03508	A114D
CR3	1901-0696 3		DIODE-PWR RECT 400V 2A 200NS	03508	A114D
DS1	1990-0442 4		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
DS2	1990-0442 4		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
DS3	1990-0442 4		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
DS4	1990-0442 4		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
DS5	1990-0442 4		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
DS6	1990-0442 4		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	5082-4486
DS7	1970-0078 0	4	TUBE, SURGE	25088	81-A350/15
DS8	1970-0078 0		TUBE, SURGE	25088	81-A350/15
F1	2110-0063 2	2	FUSE .75A 250V FAST-BLO 1.25X.25 UL IEC	28480	2110-0063
F1	2110-0065 4	2	FUSE .375A 250V FAST-BLO 1.25X.25 UL IEC	28480	2110-0065
J1	5060-7452 3	2	DIAL	28480	5060-7452
J2	1510-0090 2	8	BINDING POST ASSY SGL SGL-TUR JGK	28480	1510-0090
J3	1510-0090 2		BINDING POST ASSY SGL SGL-TUR JGK	28480	1510-0090
J4	1251-3677 7	4	CONNECTOR-TEL JACK 3-CKT .25-BHK-DIA	28480	1251-3677
J5	1510-0090 2		BINDING POST ASSY SGL SGL-TUR JGK	28480	1510-0090
J6	1510-0090 2		BINDING POST ASSY SGL SGL-TUR JGK	28480	1510-0090
J7	1251-3677 7		CONNECTOR-TEL JACK 3-CKT .25-BHK-DIA	28480	1251-3677
J8	1251-3836 0	1	CONNECTOR 4-PIN UTILITY	28480	1251-3836
J9	8120-2471				
J10	1510-0038 8	2	BINDING POST ASSY SGL THD-STUD	28480	1510-0038
J11	1250-0083 1	16	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J12	1250-0083 1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J13	1250-0083 1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J14	1250-0083 1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J15	1250-0083 1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J16	1250-0083 1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J17	1250-0083 1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
LF1	0960-0443 1	2	LINE MODULE-FILTERED	28480	0960-0443
LS1	9160-0243 4	2	LOUDSPEAKER 2 IN DIA; 8 OHM IMPD; 0.2W	28480	9160-0243
OE1	5060-0329 9	2		28480	5060-0329
P8	1251-5070 2	1	CONNECTOR	28480	1251-5070
P8	1251-4712 3	4	CONTACT-CONN U/W-UTIL FEM CRP	28480	1251-4712
R1	2100-0666 0	2	RESISTOR-VARIABLE 10K OHM 20% SPCL TPR	34263	EF9660
R2	2100-3642 8	2	RESISTOR-VAR W/SW 50K 30% 10CW DPST-NO	28480	2100-3642
S1	3101-2074 1	2	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	28480	3101-2074
S2	3101-2074 1		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	28480	3101-2074
S3			PART OF R2		
T1	9100-4008 9	1		28480	9100-4008
U1	1826-0181 1	1	IC V RGLTR TO-3 (+5V)	27014	LM323K
U2	1826-0117 3	1	IC 7812 V RGLTR TO-3 (+12V)	07263	7812KC
U3	1826-0123 1	1	IC V RGLTR TO-3 (-12V)	27014	LM320K-12
U4	1826-0145 7	1	IC 7806 V RGLTR	04713	MC7806CP
W1	04942-60054 3	1	RIBBON (A1 TO A15)	28480	04942-60054
W2			NOT ASSIGNED		
W3	04942-60053 2	1	HP-IB (A21 TO A24)	28480	04942-60053
W4	04942-60052 1	1	RIBBON (A2 TO A3)	28480	04942-60052
W5	04943-60053 3	1	POWER SWITCH (S3 TO J8)	28480	04943-60053
W6	8120-2220 4	1	POWER CORD	28480	8120-2220
W8	18061A 6	1	ANAL OUT (OPT 010)	28480	18061A

Table 6-3. Replaceable Parts (40 of 51)

INSTRUMENT COVERS

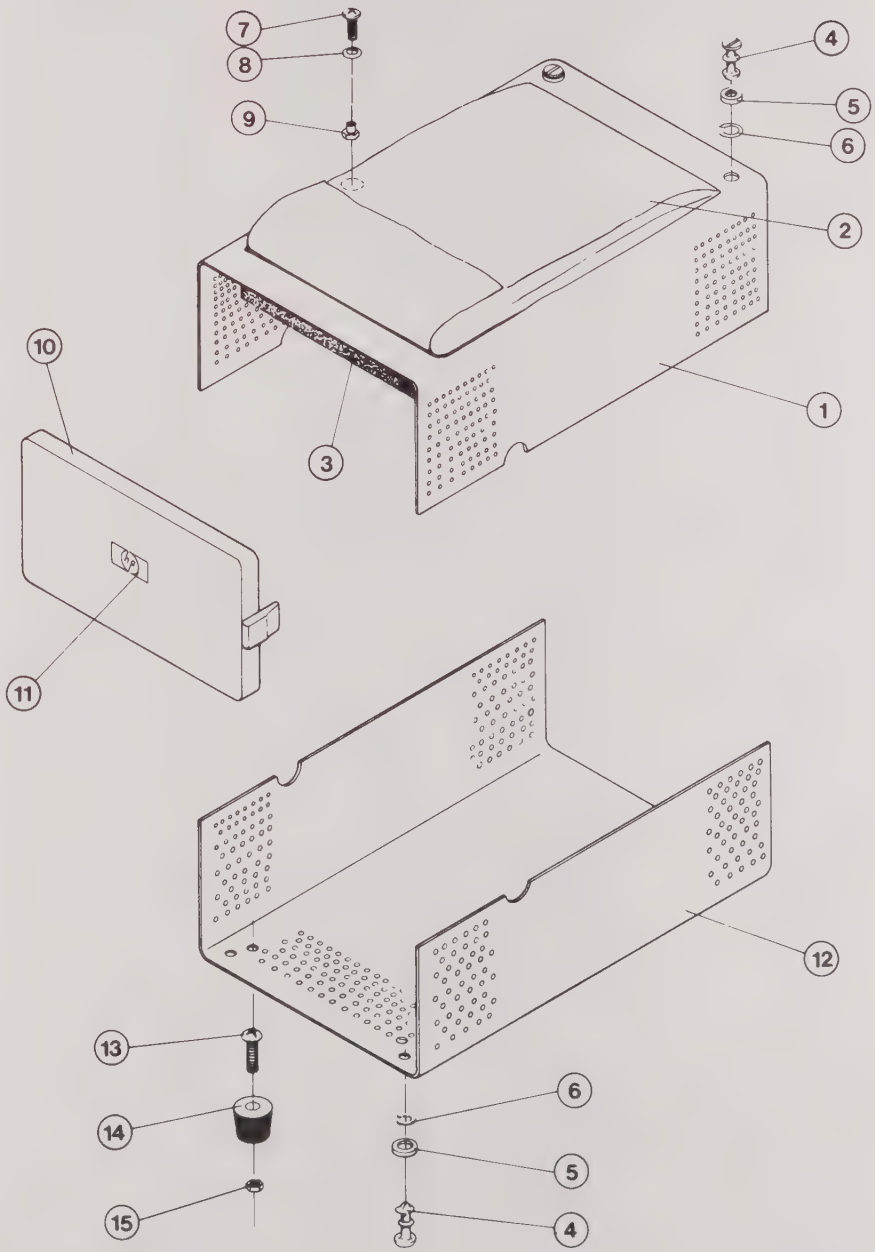


Table 6-3. Replaceable Parts (41 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			INSTRUMENT COVERS		
1	04943-00013 9	1	ASSEMBLY, TOP COVER(INCLUDES ITEMS 2 THRU 9,PLUS VINYL CLAD COVER)	28480	04943-00013
2	1540-0202 0	1	CASE-ACCESSPVC 13.5LG 10.5WD 2.5DP	28480	1540-0202
3	4208-0204 2	2	PAD, FOAM	28480	4208-0204
4	1390-0214 6	8	FASTENER-1/4-TURN STUD PANEL THKNS	28480	1390-0214
5	1390-0071 3	8	FASTENER-1/4-TURN WR WSHR 0.250 ID	28480	1390-0071
6	1390-0088 2	4	RETAINER	28480	1390-0259
7	2360-0197 2	4	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	3050-0227 3		WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
9	0510-0002 5	4	THREADED INSERT-NUT 6-32 .062-LG STL	28480	0510-0002
10	5040-0516 4	1	COVER, FRONT	28480	5040-0516
11	7120-4184 2	1	PLATE, ID	28480	7120-4184
12	04943-00014 0	1	ASSEMBLY, BOTTOM COVER(INCL ITEMS 4 THRU 6, 13 THRU 15, AND VINYL COVER)	28480	04943-00014
13	2510-0107 3	4	SCREW-MACH 8-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
14	0403-0176 7	4	BUMPER FOOT-SCR .938-IN-OD .562-IN-THK	28480	0403-0176
15	2580-0003 5	4	NUT-HEX-W/LKWR 8-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION

Table 6-3. Replaceable Parts (42 of 51)

CHASSIS PARTS

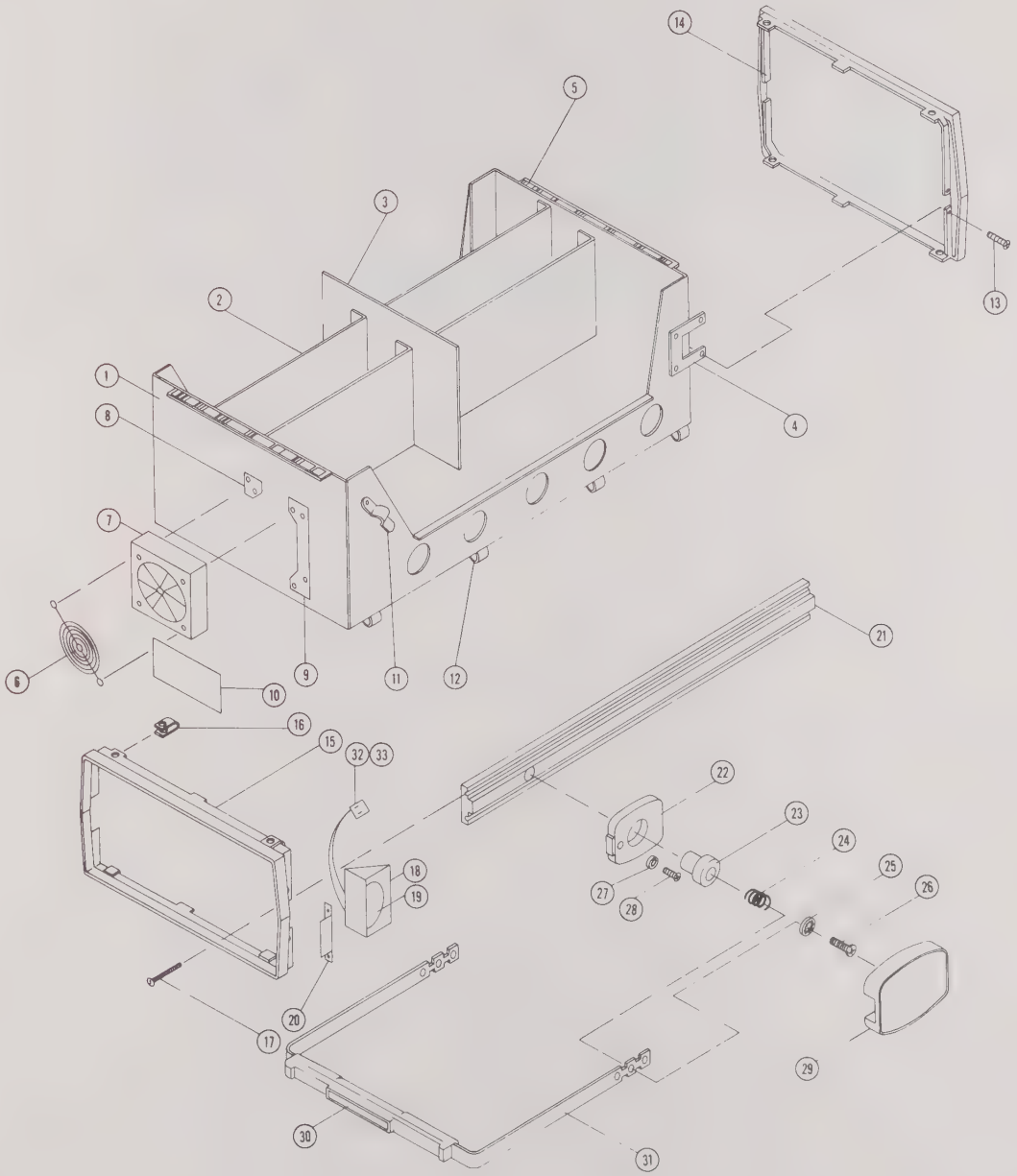


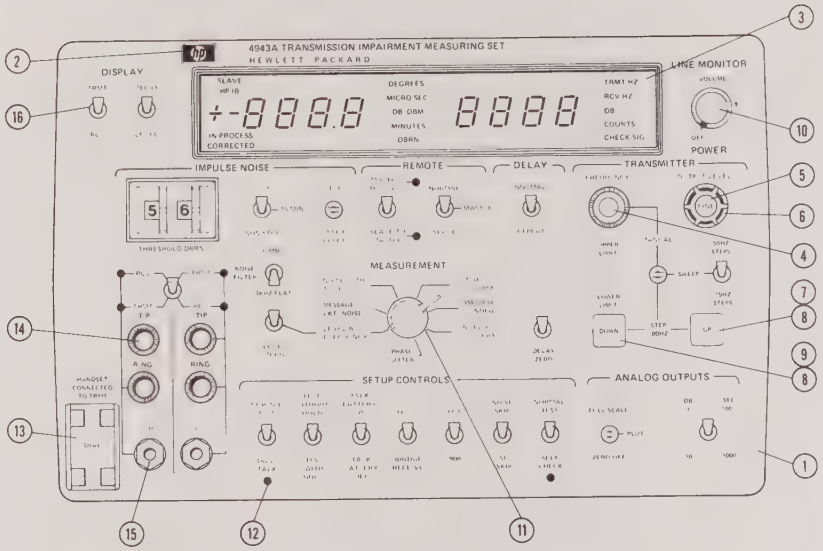
Table 6-3. Replaceable Parts (43 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS		
1	04942-00030 9	1	CARD CAGE	28480	04942-00030
2	04942-00005 8	4	SHIELD	28480	04942-00005
3	04942-00002 5	2	SEPARATOR	28480	04942-00002
4	04942-00015 0	2	BRACKET	28480	04942-00015
5	7120-5548 4	2	LABEL SET	28480	7120-5548
6	3160-0300 6	1	GUARD	28480	3160-0300
7	3160-0297 0		FAN-TBAX 19-CFM 115V 50/60-HZ .984-THK (B1)	28480	3160-0297
8	04943-00019 5	1	BRACKET	28480	04943-00019
9	04943-00017 3	1	BRACKET	28480	04943-00017
10	04943-00010 6	1	SHIELD, AIR	28480	04943-00010
11	1400-0617 6	3	CLIP-TENSION 0.38-IN RND CAPACITY	28480	1400-0617
	0361-0009 5	13	RIVET	28480	0361-0009
12	1400-0024 9	5	CLAMP-CABLE .25-DIA .5-WD NYL	28480	1400-0024
13	2360-0115 4	8	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
14	04942-20027 5	1	CASTING, REAR	28480	04942-20026
15	04942-20026 6	1	CASTING, FRONT	28480	04942-20027
16	1390-0091 7	8	FASTENER-1/4-TURN RCPT PANEL THKNS	28480	1390-0091
17	0624-0279 9	8	SCREW-TPG 8-32 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
18	5040-7695 4	1	SPEAKER HOLDER	28480	5040-7695
19	9160-0229 4		LOUDSPEAKER 2 IN DIA; 8 OHM IMPD; 0.24 (LS1)	28480	9160-0229
20	04943-00004 8	1	BRACKET	28480	04943-00004
21	01740-23701 9	2	RAIL	28480	01740-23701
22	5020-8734 2	2	GEAR, RING	28480	5020-8734
23	5020-8733 1	2	GEAR	28480	5020-8733
24	1460-0604 7	2	SPRING-CPRSN .95-IN-OD 1.185-IN-LG MUW	28480	1460-0604
25	2190-0010 7	2	WASHER-LK EXT T NO. 8 .168-IN-ID	28480	2190-0010
26	2510-0113 1	2	SCREW-MACH 8-32 .875-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
27	2190-0007 2	4	WASHER-LK INTL T NO. 6 .141-IN-ID	28480	2190-0007
28	2360-0201 9	4	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
29	5040-0511 9	2	CAP	28480	5040-0511
30	7120-6281 4	1	LABEL	28480	7120-6281
31	5040-0515 3	1	HANDLE	28480	5040-0515
32	1251-4732 7	1	CONNECTOR 2-PIN F POST TYPE (A3P1)	28480	1251-4732
33	1251-4551 8	2	CONTACT-CONN U/W-POST-TYPE FEM CRP (A3P1)	28480	1251-4551
			MISCELLANEOUS		
	2200-0103 2	8	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0105 4	4	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0195 0	14	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2510-0103 9	4	SCREW-MACH 8-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2260-0012 8	18	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	3050-0227 3	5	WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
	2190-0007 2	15	WASHER-LK INTL T NO. 6 .141-IN-ID	28480	2190-0007
	1400 0293	1	CLAMP CABLE	28480	1400 0293
	2360 0199	1	1 SCREW MACH 6 32 .438 IN LG	00000	2360 0199

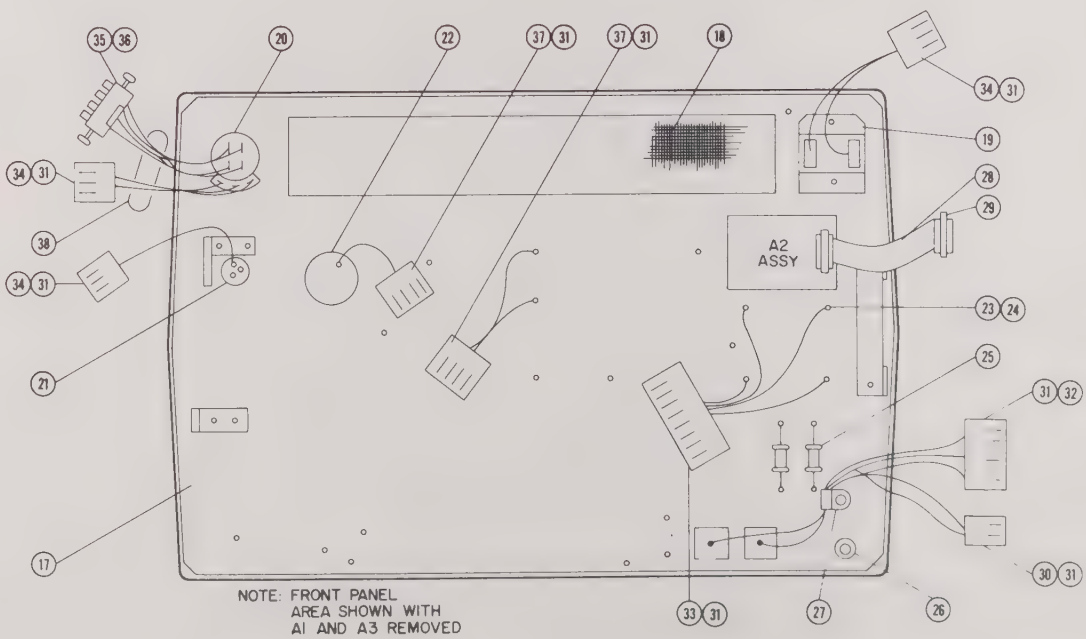
Table 6-3. Replaceable Parts (44 of 51)

FRONT PANEL AREA

FRONT PANEL – FRONT VIEW



FRONT PANEL – REAR VIEW



NOTE: FRONT PANEL AREA SHOWN WITH A1 AND A3 REMOVED

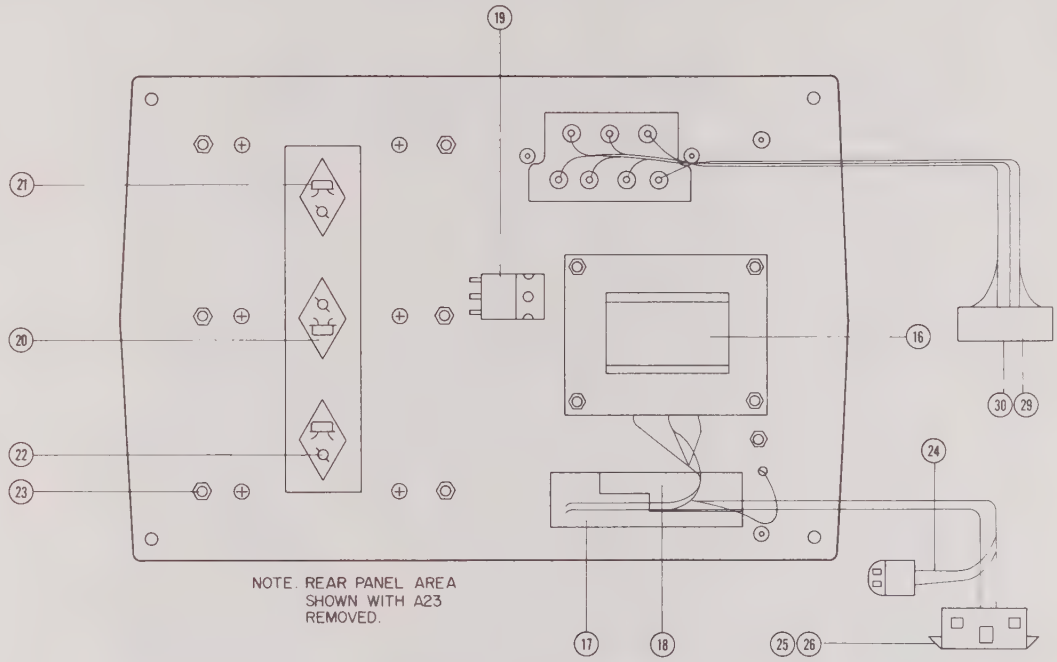
Table 6-3. Replaceable Parts (45 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			FRONT PANEL AREA		
1	04943-00001 5	1	PANEL, STD W/PHASE JITTER	28480	04943-00001
1	04943-00002 6	1	PANEL (OPT. 011)	28480	04943-00002
1	04943-00009 3	1	PANEL, FRONT (OPT. 012-NLD)	28480	04943-00009
2	7120-1254 1	1	NAMEPLATE .312-IN-WD .54-IN-LG AL	28480	7120-1254
3	4040-1059 1	1	BEZEL, DISPLAY	28480	4040-1059
4	0370-1091 6	1	KNOB, ROUND	28480	0370-1091
5	0370-0963 9	1	KNOB, FINE	28480	0370-0963
6	0370-0667 0	1	KNOB-CONC 1/2 JGK .252-IN-ID	28480	0370-0667
7	5041-0039 8	1	CAP, PUSHBUTTON, UP	28480	5041-0039
8	5040-6885 2	2	EXTENDER, PUSHBUTTON SWITCH	28480	5040-6885
9	5041-0038 7	1	CAP, PUSHBUTTON, DOWN	28480	5041-0038
10	0370-1099 4	1	KNOB, POINTER	28480	0370-1099
11	0370-3000 1	1	KNOB, LEVER	28480	0370-3000
12	1450-0513 6	8	LENS CAP RED-TL .124-DIA SNAP IN	28480	1450-0513
13	5060-7452 3	1	CONNECTOR, 2-CONT, DIAL (J1)	28480	5060-7452
14	1510-0090 2	4	BINDING POST ASSY SGL SGL-TUR JGK (J2,J3,J5,J6)	28480	1510-0090
15	1251-3677 7	2	CONNECTOR-TEL JACK 3-CKT .25-SHK-DIA (J4, J7)	28480	1251-3677
16	3101-2074 1	2	SWITCH, TOGGLE (S1, S2)	28480	3101-2074
17	04943-60092 0	1	PANEL, SUB(INCL PRESS-IN STUDS & STANDOFF	28480	04943-60092
18	04943-00018 4	1	SHIELD, RFI DISPLAY	28480	04943-00018
19	04942-00013 8	1	BRACKET, DISPLAY SWITCH	28480	04942-00013
20	2100-3642 8	1	RESISTOR-VAR W/SW 50K 30% 10CW DPST-NO (R2, S3)	28480	2100-3642
21	2100-0666 0	1	RESISTOR-VARIABLE 10K OHM 20%) SPCL TPR (R1)	34263	EF9660
22	5060-0329 9	1	ENCODER, OPTICAL (OE1)	28480	5060-0329
23	1990-0442 4	6	LED-VISIBLE LUM-INT=300UCD IF=50MA=MAX (DS1-6)	28480	5082-4486
24	4040-0706 3	6	BASE, LENS (XDS3-6)	28480	4040-0706
25	1970-0078 0	2	TUBE-ELECTRON SURGE V PTCTR (DS7, 8)	25088	B1-A350/15
26	0340-0732 7	2	INSULATOR-BDG POST POLYC (FOR J1)	28480	0340-0732
27	1400-0024 9	1	CLAMP-CABLE .25-DIA .5-WD NYL	28480	1400-0024
28	04942-60052 1	1	CABLE, RIBBON 14-COND (W4)	28480	04942-60052
29	1200-0547 7	2	LOCK-DUAL INLINE PKG IC FOR 14 PIN (FOR W4)	28480	1200-0547
30	1251-4732 7	1	CONNECTOR 2-PIN F POST TYPE (A5P3)	28480	1251-4732
31	1251-4551 8	33	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4551
32	1251-4728 1	1	CONNECTOR 6-PIN F POST TYPE (A6P1)	28480	1251-4728
33	1251-4731 6	1	CONNECTOR 8-PIN F POST TYPE (A3P5)	28480	1251-4731
34	1251-4829 2	3	CONNECTOR 3-PIN F POST TYPE (A3P4, A3P6, A5P4)	28480	1251-4829
35	1251-3836 9	1	CONNECTOR 4-PIN M POST TYPE (J8)	28480	1251-3836
36	1251-4875 9	4	CONTACT-CONN U/W-UTIL MALE CRP	28480	1251-4875
37	1251-4730 5	2	CONNECTOR 4-PIN F POST TYPE (A1A2P2, A3P3)	28480	1251-4730
38	04943-60053 3	1	CABLE ASSEMBLY (W5) (INCLUDES 20, 35, & 36)	28480	04943-60053
			MISCELLANEOUS		
	8120-0202 8	36 in.	CABLE-SHLD 22AWG 2-CNDCT BLK-JKT	28480	8120-0202
	0520-0164 1	4	SCREW-MACH 2-56 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	2200-0113 4	17	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0115 6	6	SCREW-MACH 4-40 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	0610-0002 7	4	NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
	2420-0015 1	7	NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2950-0043 8	11	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2190-0014 1	4	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
	3050-0227 3		WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
	3050-0304 7	2	WASHER-FL MTLC 5/16 IN .375-IN-ID	28480	3050-0304
	2190-0016 3	8	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2190-0448 5	1	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	2190-0448
	2190-0833 2	1	WASHER-FL MTLC 5/16 IN .378-IN-ID	28480	2190-0833
	1400-0249 0	1	CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249
	1400-0903 3	1	CLAMP	28480	1400-0903

Table 6-3. Replaceable Parts (46 of 51)

REAR PANEL AREA

REAR PANEL – FRONT VIEW



REAR PANEL – REAR VIEW

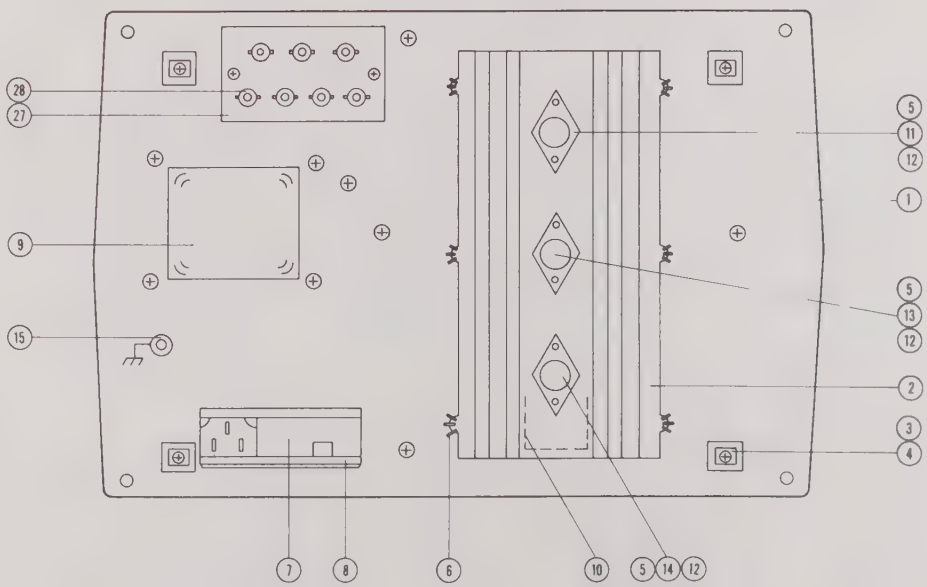


Table 6-3. Replaceable Parts (47 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			REAR PANEL AREA		
1	04943-00020 8	1	PANEL, REAR	28480	04943-00020
2	1205-0299 6	1	HEAT SINK, FINNED	28480	1205-0299
3	5040-5861 2	4	FOOT:BASE	28480	5040-5861
4	5040-5862 3	4	FOOT:REAR,CAP	28480	5040-5862
5	0340-0833 9	3	INSULATOR-XSTR NYLON BLACK	28480	0340-0833
6	0340-0832 8	6	INSULATOR NYLON	28480	0340-0832
7	2110-0063 2	1	FUSE .75A 250V FAST-BLO 1.25X.25 UL IEC (F1)	28480	2110-0063
7	2110-0065 4	1	FUSE .375A 250V FAST-BLO 1.25X.25 UL IEC (F1)	28480	2110-0065
8	7120-6242 7	1	LABEL-INFORMATION .21-IN-HO .233-IN-LG	28480	7120-6242
9	01710-04103 9	1		28480	01710-04103
10	0905-0687 9	1	GASKET RECT NPRN-FM .312-THK 5.8-LG	28480	0905-0687
11	1826-0123 1		IC V RGLTR TO-3	27014	LM320K-12
12	0340-0417 5	3	INSULATOR-XSTR THERMA-FILM	28480	0340-0417
13	1826-0117 3	1	IC 7812 V RGLTR TO-3 (U2)	07263	7812KC
14	1826-0181 1	1	IC V RGLTR TO-3 (U1)	27014	LM323K
15	1510-0038 8	1	BINDING POST ASSY SGL THD-STUD (J10)	28480	1510-0038
16	9100-4008 9	1	TRANSFORMER (T1)	28480	9100-4008
17	0960-0443 1	1	LINE MODULE-FILTERED (LF1)	28480	0960-0443
18	5950-3816 2	1	LABEL, HI-VOLTAGE	28480	5950-3816
19	1826-0145 7	1	IC 7806 V RGLTR (U4)	04713	MC7806CP
20	1200-0536 4	3	SOCKET-XSTR 3-CONT TO-3 SLDR-EYE	28480	1200-0536
21	0160-0174 9	3	CAPACITOR-FXD .47UF +80-20% 25VDC CER (C1-3)	28480	0160-0174
22	1901-0696 3	3	DIODE-PWR RECT 400V 2A 200NS (CR1-CR3)	03508	A114D
23	0380-0093 7	6	STANDOFF-HEX .5-IN-LG 6-32THD .25-IN-A/F	00000	ORDER BY DESCRIPTION
24	8120-2471 7	1	CABLE ASSY 18AWG 2-CNDCT BLK-JKT (J9)	28480	8120-2471
25	1251-5070 8	1	CONN (P8)	28480	1251-5070
26	1251-4712 3	4	CONTACT-CONN U/W-UTIL FEM CRP (P8)	28480	1251-4712
27	04943-00005 9	1		28480	04943-00005
28	1250-0083 1	7	CONNECTOR-RF BNC FEM 50-OHM (J11-17)	28480	1250-0083
29	1251-4731 6	1	CONNECTOR 8-PIN F POST TYPE (A5P5)	28480	1251-4731
30	1251-4551 8	8	CONTACT-CONN U/W-POST-TYPE FEM CRP (A5P5)	28480	1251-4551
			MISCELLANEOUS		
	0624-0213 1	3	SCREW-TPG 6-32 .5-IN-LG 82 DEG	28480	0624-0213
	2200-0105 4	3	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0195 0	10	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0201 9	6	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0135 8	2	SCREW-MACH 6-32 1.5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0302 1	2	SCREW-MACH 6-32 1.625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2510-0109 5	6	SCREW-MACH 8-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2680-0071 9	4	SCREW-MACH 10-32 1.75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2950-0006 3	1	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2260-0002 6	1	NUT-HEX-DBL-CHAM 4-40-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
	2740-0006 8	4	NUT-HEX-W/LKWR 10-32-THD .125-IN-THK	28480	2740-0006
	2950-0001 8	7	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	3050-0227 3	4	WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
	2190-0004 9	1	WASHER-LK INTL T NO. 6 .115-IN-ID	28480	2190-0004
	2190-0046 9	6	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0046
	2190-0007 2	12	WASHER-LK INTL T NO. 6 .141-IN-ID	28480	2190-0007
	2190-0010 7	6	WASHER-LK EXT T NO. 8 .168-IN-ID	28480	2190-0010
	2190-0016 3	7	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2190-0027 6	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0027
	0360-0001 5	1	TERMINAL-SLDR LUG LK-MTG FOR-#6-SCR	28480	0360-0001
	0360-1190 5	7	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
	1400-0249 0	14	CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249

Table 6-3. Replaceable Parts (48 of 51)

REAR PANEL AREA WITH HP-IB AND ANALOG OUTPUTS
(MODEL 4943A – OPT 010)

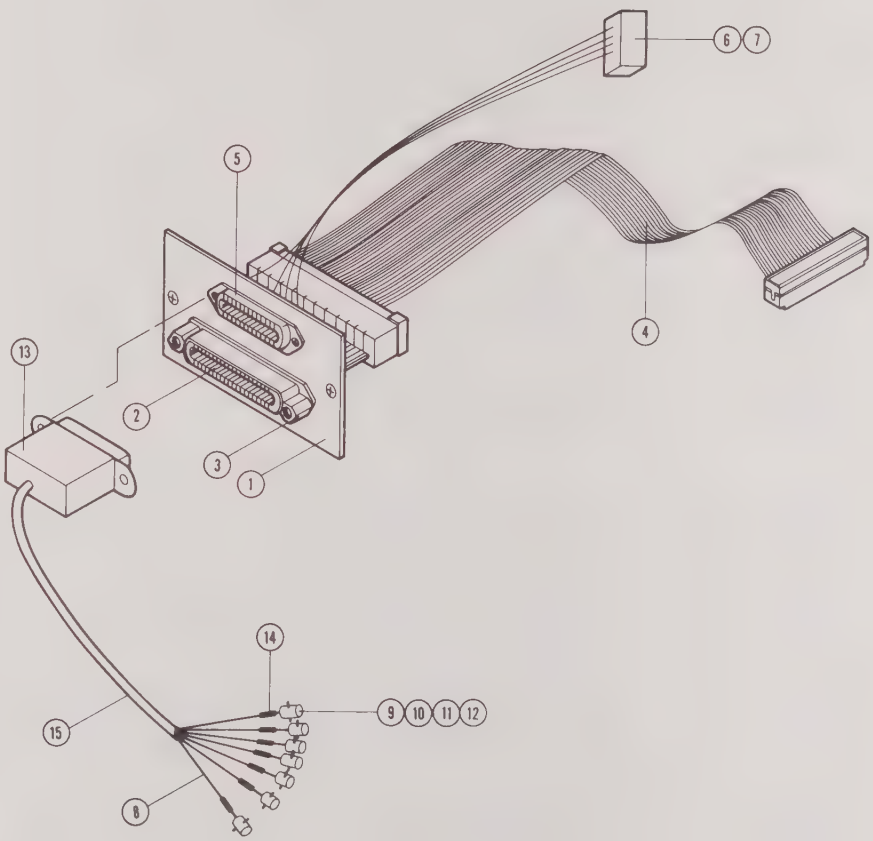


Table 6-3. Replaceable Parts (49 of 51)

Reference Designation	HP Part Number		Qty	Description	Mfr Code	Mfr Part Number
				REAR PANEL AREA WITH HP-IB (OPT. 010)		
1	04943-00007	1	1	PLATE	28480	04943-00007
2	04942-60024	7		PC ASSEMBLY,INCLUDES 24-CONT F CONNECTOR & PC BD (A24)	28480	04942-60024
3	0380-0643	3	2	STANDOFF, LG STUD MOUNT(METRIC THREAD)	00468	OBD#
4	04942-60053	2		CABLE ASSEMBLY (W3)	28480	04942-60053
5	1251-0143	6	1	CONNECTOR 14-PIN F MICRO RIBBON (W2J1)	28480	1251-0143
6	1251-4731	6	1	CONNECTOR 8-PIN F POST TYPE (A5P5)	28480	1251-4731
7	1251-4551	8	8	CONTACT-CONN U/W-POST-TYPE FEM CRP (A5P5)	28480	1251-4551
8	8120-0124	3	4.5 ft	CABLE-COAX 50-OHM BLK 30PF/FT	28480	8120-0124
9	1250-0252	6	7	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0252
10	1250-0051	3	7	CONTACT-RF CONN SERIES BNC: FEMALE	02660	31-2109
11	1250-0050	2	7	NUT-RF CONNECTOR BNC1.562 LI.062ID	02660	31-2125-2
12	1250-0960	3	7	SLEEVE-RF CONN SER BNC/TNC	28480	1250-0960
13	1251-0142	5	1	CONNECTOR 14-PIN M MICRO RIBBON	28480	1251-0142
14	7120-6784	2	1		28480	7120-6784
15	18061A	6	1	CABLE ASSEMBLY (W8) INCL 8 THRU 14	28480	18061A
				MISCELLANEOUS		
	7120-5911	5	1	LABEL, METRIC	28480	7120-5911
	2420-0015	1	2	NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	0590-0085	2	2	NUT-HEX-DBL-CHAM 3-48-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
	2190-0031	2	2	WASHER-LK INTL T NO. 3 .102-IN-ID	28480	2190-0031
	0525-0043	5	2	SCREW-MACH 3-48 .375-IN-LG RD-HD-SLT	00000	ORDER BY DESCRIPTION
	1400-0249	0	3	CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249

Table 6-3. Replaceable Parts (50 of 51)

REAR PANEL AREA WITH HP-IB, WITHOUT ANALOG OUTPUTS
(MODEL 4943A – OPT 011)

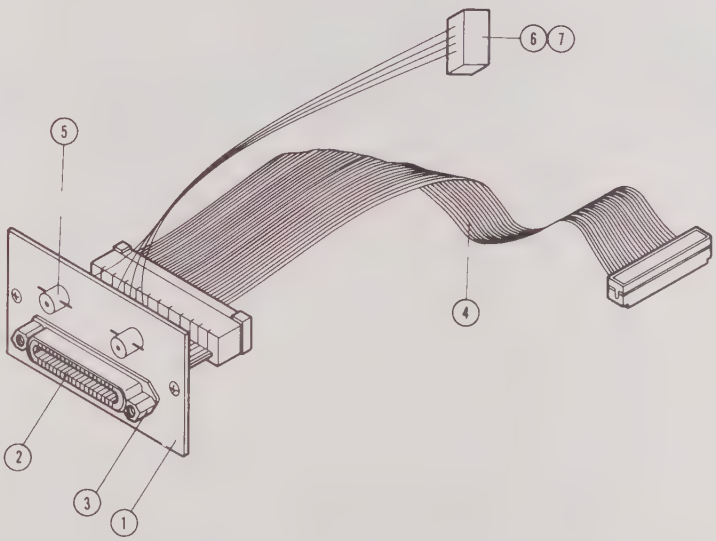


Table 6-3. Replaceable Parts (51 of 51)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			REAR PANEL AREA WITH HP-IB, W/O ANALOG OUTPUTS (OPT. 011)		
1	04943-00011 7	1	PLATE	28480	04943-00011
2	04942-60024 7	1	PC ASSEMBLY, INCL. 24-CONT F CONN & PC BOARD (A24)	28480	04942-60024
3	0380-0643 3	2	STANDOFF, LG STUD MOUNT(METRIC THREAD)	00468	080#
4	04942-60053 2	1	CABLE ASSEMBLY (W3)	28480	04942-60053
5	1250-0083 1	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (J14, 15)	28480	1250-0083
6	1251-4731 6	1	CONNECTOR 8-PIN F POST TYPE (A5P5)	28480	1251-4731
7	1251-4551 8	3	CONTACT-CONN U/W-POST-TYPE FEM CRP (A5P5)	28480	1251-4551
			MISCELLANEOUS		
	7120-5911 5	1	LABEL	28480	7120-5911
	2420-0015 1	2	NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2190-0016 3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	0360-1190 5	2	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-8CR	28480	0360-1190
	1400-0249 0	3	CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249

Table 6-4. Code List of Manufacturers

MFR. NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	Any Satisfactory Supplier		
0046B	No M/F Description for this Mfg Number		
01121	Allen-Bradley Co.	Milwaukee, WI	53204
01295	Texas Instr. Inc. Semicond. Cmpnt. Div.	Dallas, TX	75222
0144B	S.E.I. Mfg	Northridge, CA	91324
0192B	RCA Corp. Solid State Div.	Somerville, NJ	08876
02111	Spectrol Electronics Corp.	City of Ind, CA	91745
02660	Amphenol Sales Div. of Bunker-Ramo	Broadview, IL	60153
03508	G.E. Co. Semiconductor Prod. Dept.	Syracuse, NY	13201
03888	KDI Pyrofilm Corp.	Whippany, NJ	07981
03911	Clairex Corp.	Mt. Vernon, NY	10050
04713	Motorola Semiconductor Products	Phoenix, AZ	85062
06665	Precision Monolithics Inc.	Santa Clara, CA	95050
07263	Fairchild Semiconductor Div.	Mountain View, CA	94042
07933	Raytheon Co. Semiconductor Div. Hq.	Mountain View, CA	94040
17856	Siliconix Inc.	Santa Clara, CA	95054
18324	Signetics Corp.	Sunnyvale, CA	94086
19701	MEPCO/Electra Corp.	Mineral Wells, TX	76067
23880	Stanford Applied Engineering Inc.	Santa Clara, CA	95050
24355	Analog Devices Inc.	Norwood, MA	02062
24546	Corning Glass Works (Bradford)	Bradford, PA	16701
24602	EMC Technology Inc.	Philadelphia, PA	19107
2484A	No M/F Description for this Mfg Number		
25088	Siemens Corp.	Iselin, NJ	08830
25403	Amperex Elek Corp Semicon & MC Div.	Slatersville, RI	02876
27014	National Semiconductor Corp.	Santa Clara, CA	95051
27167	Corning Glass Works (Wilmington)	Wilmington, NC	28401
28480	Hewlett-Packard Co. Corporate Hq.	Palo Alto, CA	94304
29832	Teledyne Philbrick Nexus	Dedham, MA	02026
34263	CTS of Brownsville Inc.	Brownsville, TX	78520
34371	Harris Semicon Div. Harris-Intertype	Melbourne, FL	32901
34649	Intel Corp.	Mountain View, CA	95051
50088	Mostek Corp.	Carrollton, TX	75006
52063	Exar Integrated Systems Inc.	Sunnyvale, CA	94086
54294	Cutler-Hammer-Inc. Shallcross Mfg. Co.	Selma, NC	27576
56289	Sprague Electric Co.	North Adams, MA	01247
72136	Electro Motive Corp. Sub. IEC	Willimantic, CT	06226
82647	Texas Inst. Dept. Control Prod. Div.	Attleboro, MA	02703
84411	TRW Capacitor Div.	Ogallala, NE	69153
91637	Dale Electronics Inc.	Columbus, NE	68601
9977J	No M/F Description for this Mfg Number		

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section provides information for making this manual applicable to earlier configurations of the Model 4943A. Enter the backdating information (or the change number, if more convenient) into the appropriate places in the manual.

INSTRUMENT CHANGES

INSTRUMENT SERIAL NUMBER	MAKE CHANGES
1731A-00125 and below	1
1731A-00125 and below	2 & 3
1731A-00140 and below	4
1731A-00138 and below	5
1731A-00175 and below	6
1731A-00290 and below	16
1731A-0031 and below	17

ASSEMBLY CHANGES

ASSEMBLY REF. DES.	DESCRIPTION	SERIES	MAKE CHANGES
A10	TRMT & CONT	1605	1
A14	ENV DEL	1725	2
A9	FILT MOD	1605	3
A8	MODEM	1730	4
A18	LOG. DET./QUANT	1727	5
A6	INPUT	1727	6
A19	FREQ. TRACK.	1727	7
A20	ANALOG O/P	1727	7
A8	MODEM	1910	8
A8	MODEM	1741	9
A17	NOTCH FILTER PROG. AMP.	1727	10
A15	MICROPROCESSOR ASSY	1935	13
A15	MICROPROCESSOR ASSY	1928	12
A15	MICROPROCESSOR ASSY	1727	11
A17	NOTCH FILTER PROG. AMP.	1727	14
A15	MICROPROCESSOR ASSY	1944	15
A3	SWITCH ASSY	A-1727	16
A5	MOTHER BD	A-1727	16
A6	INPUT BD	B-1826	16
A17	NOTCH FILTER PROG. AMP	B-1937	16
A13	INST COVERS	2015A	17
A14	ENV DEL	2015A	17

CHANGE NO. 1

Page 6-17, Table 6-3:

Change A10U8 to 1820-1328.

Delete A10U15.

Page 8-68, Figure 8-44:

Delete U15.

Change series code to A-1605-38.

Page 8-69, Figure 8-45:

Change series code to 1605.

Replace U8, U15, and U7 with:

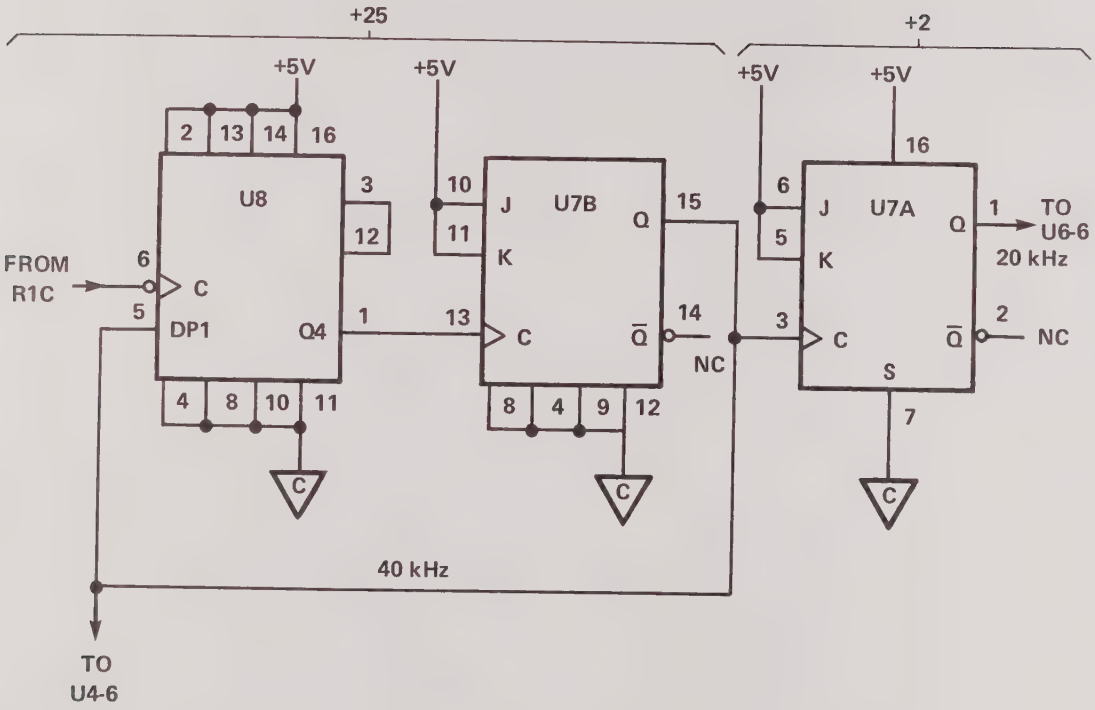


Figure 7-1

CHANGE NO. 2

Page 6-24, Table 6-3:

Change A14U15 to 1820-1328.

Page 8-76, Figure 8-52:

Change series code to D-1725-38.

Page 8-77, Figure 8-53:

Change series code to 1725.

Repiace U15 with:

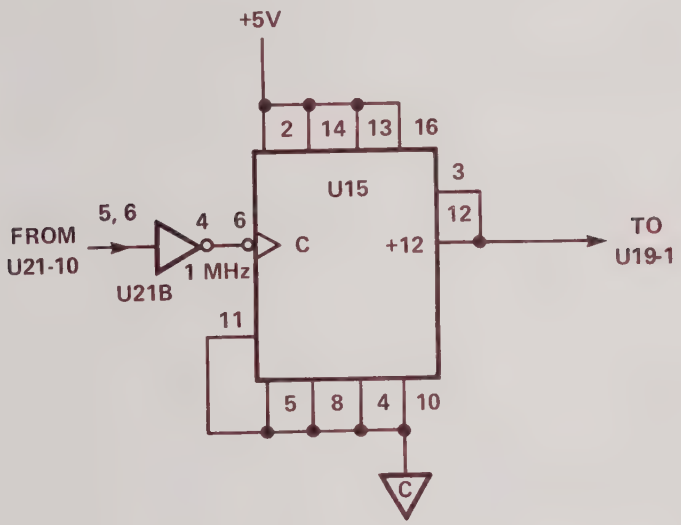


Figure 7-2

CHANGE NO. 3

Page 6-15, Table 6-3:

Add A9C8, 0180-1746, 15 UF, 20V.
Delete A9C19, 0160-2453.
Add A9R17, 0757-0422, 909 ohms, 1%.
Add A9R18, 0757-0442, 10K ohms, 1%.
Change A9R26 to 0757-0290, 6190, 1%.
Delete A9R42 and A9R43.
Change A9VR1 to 1990-0449.

Page 8-66, Figure 8-41:

Change series code to C-1605-38.
Change R43 to R18, R42 to R17, and C19 to C8.

Page 8-67, Figure 8-43:

Change series code to 1605.
Change R26 to 6190.
Change circuit around U2A and Q1 as follows:

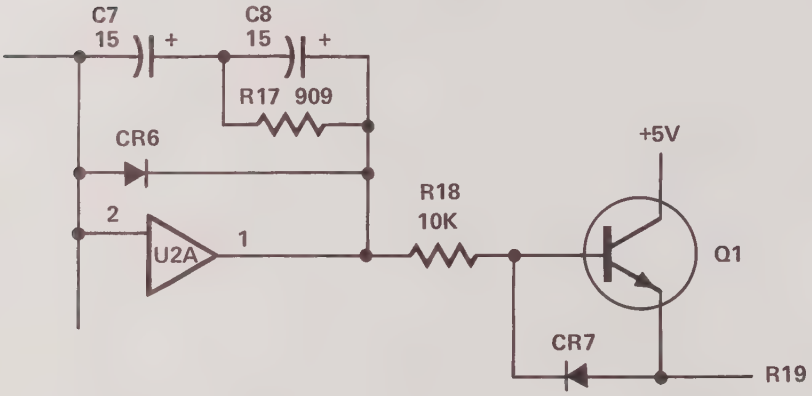


Figure 7-3

CHANGE NO. 4

Page 6-13, Table 6-3:

Add A8Q4, 1854-0019, TRANSISTOR, NPN, SI

Page 6-14, Table 6-3:

Add A8R109, 0757-0442, 10K.

Add A8R110, 0757-0280, 1K.

Page 6-15, Table 6-3:

Change A8U26 to 1820-0949, CD4011AF.

Page 8-62, Figure 8-38:

Change series code to D-1730-38.

Add R110, between U26 and U27, just above C18.

Add R109, just below U21, and to the right of C4.

Add Q4, below U21 and U22, and centered between them.

Page 8-63, Figure 8-39:

Change series code to 1730.

At U26A, change input to pins 1, 2. Change output to pin 3.

At U26B, change input to pins 8, 9, and change output to pin 10.

This inverter is now U26C.

In place of U26C, D, and E, the following circuit is present:

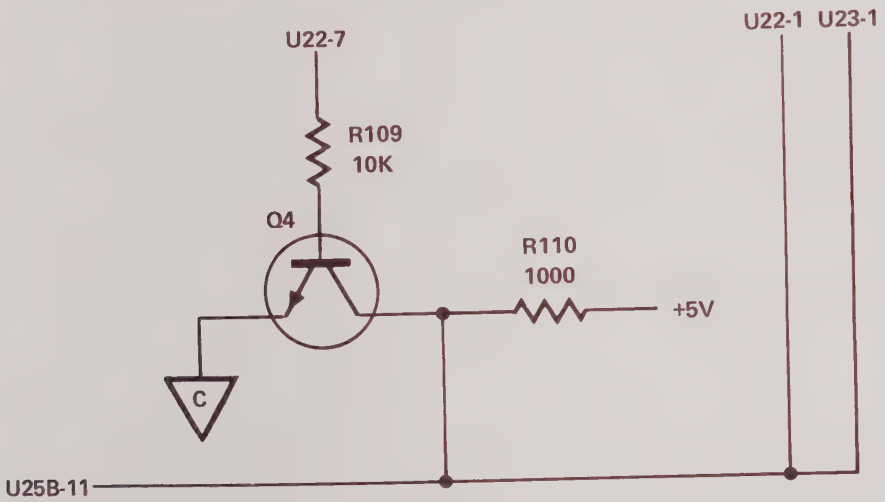


Figure 7-4

Page 8-65, Figure 8-40:

At U26F, change pin 15 to 5, 14 to 6, and 13 to 4. This gate is now U26B.

CHANGE NO. 5

Page 6-29, Table 6-3:

Change A18C28 to 016-4397 (check digital);
Qty 1; Caps Fxd .1uf ±1% 100VDC
Poly; Mfr. Code 28480; Mfr. Part 0160-4397.

Page 6-30, Table 6-3:

Change A18R51 to 0698-8343.
Resistor 590K Mfr. Code 28480; Mfr. Part No. MFC/8-T0-5903-F
Delete A18R61

Page 6-31, Table 6-3:

Change A18U11 to 1820-1317, IC M.V. CMOS MONO/ASTBL
Mfr. Code 0192B; Mfr. Part No. CD4047AE

Page 8-98, Figure 8-61:

Replace with Figure 7-5

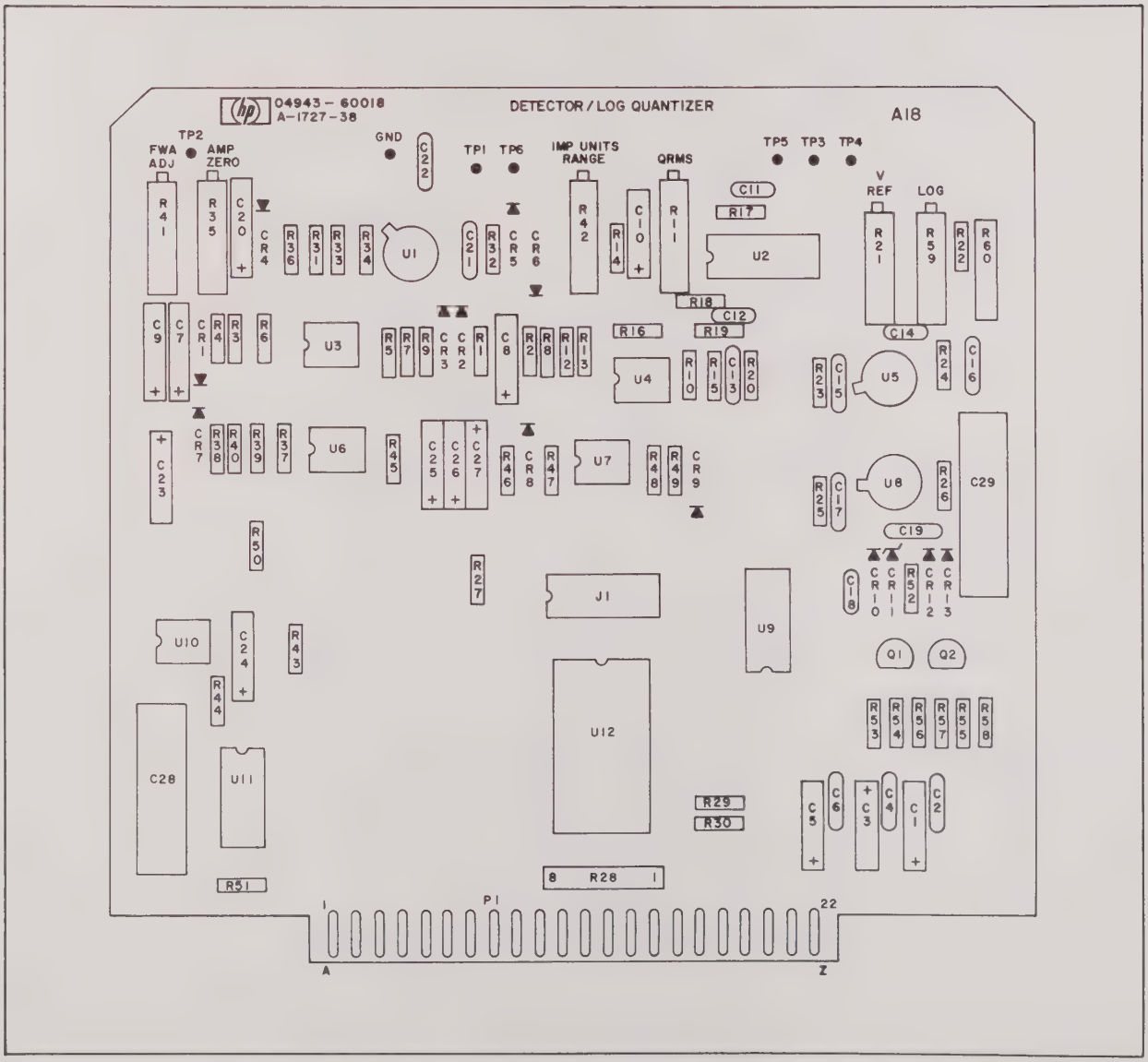


Figure 7-5. A18 Detectors and Log Quantizer Component Locator

Page 8-99, Figure 8-63:

Make changes to schematic as shown in the following partial diagram:

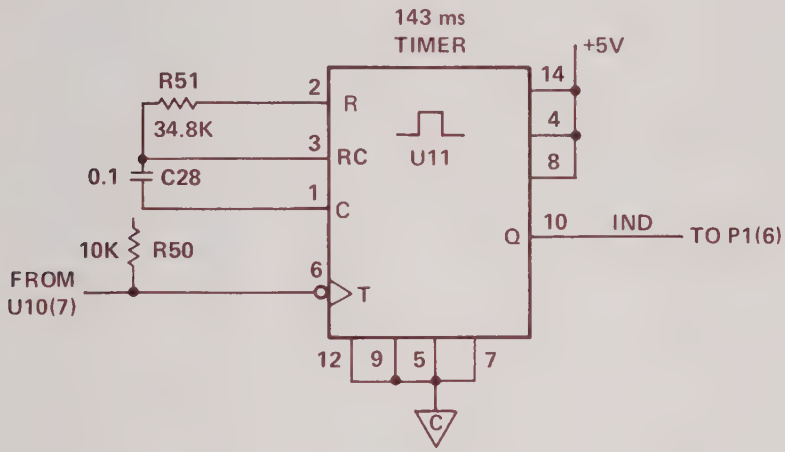


Figure 7-6.

Change A18 schematic series number to 1727

CHANGE NO. 6

Page 6-10, Table 6-3:

Change A6R41 to 0698-3159;
Resistor 26.1K, Mfr. Part No. C4-1/8-T0-2612-F

Page 8-58; 8-59:

Change A6 component locator date-code to 1727.
Change A6R41 to 26.1K.
Change A6 Schematic Series number to 1727.

CHANGE NO. 7

Page 6-32, Table 6-3:

Change A19R32, 33 to 0757-0482; Quantity 2; RESISTOR FXD 511K 1% .125W; Mfr. Code 28480; Mfr. Part Number 0757-0482

Page 6-33, Table 6-3:

Change A19U6 to 1820-1356; Quantity 1; Mfr. Part Number MC14528BCP.

Page 8-100, Fgiure 8-64:

Change A19 Component Locator date-code to 1727.

Page 8-101, Figure 8-65 A19 Assembly:

Change R32, R33 to 511K.
Change U6A, B to 24 MS
Change A19 Schematic Series Number to 1727.

Page 5-2, Table 5-1 Related Adjustments:

Add: A20 Analog; Analog Outputs Adjustment; 5-26

Page 5-19, Paragraph 5-26:

Add following Adjustment Procedure for A20

Replacement Paragraph for Paragraph 5-26

5-26. ANALOG OUTPUTS ADJUSTMENT

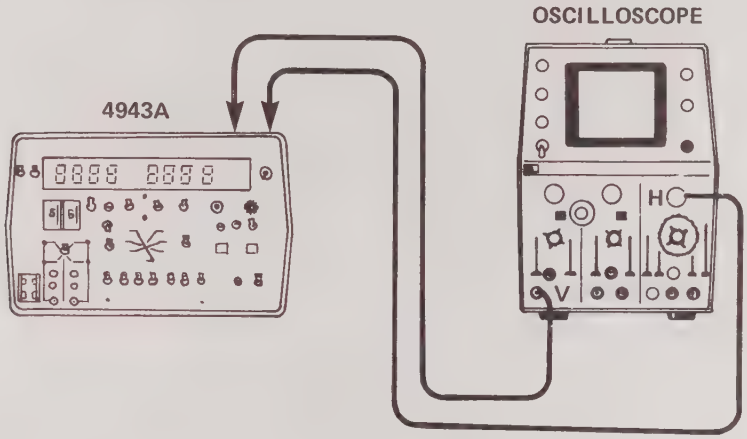


Figure 5-12. Analog Outputs Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Oscilloscope

PC BOARD AFFECTED: A20.

SETUP CONDITIONS: 4943A:

MEASUREMENT ..... LEVEL & FREQUENCY
DISPLAY TRMT/RCV ..... RCV
SETUP CONTROLS ..... UP
TRMT/RCV JACKS ..... Left jack field TRMT
Right jack field RCV

Oscilloscope

VERTICAL ..... 2V/div.
HORIZONTAL ..... EXT. HORIZ

Loop TRMT/RCV jacks

PROCEDURE:

1. Connect oscilloscope VERTICAL INPUT to 4943A rear panel SCOPE VERT BNC jack.
2. Connect oscilloscope EXT HORIZONTAL to 4943A rear panel SCOPE HORIZ BNC jack.
3. Switch to SELF-CHECK. Depress and hold LEVEL ZERO switch until display shows dashed lines, then release. Five horizontal graticule lines should appear on the oscilloscope (the second line from the top should appear brighter than the others).
4. Adjust A20R21 so that each graticule is 2 volts high (total = 10V).
5. Adjust A20R33 for full scale width on oscilloscope (10 volts).

Page 5-27 and 5-29
Replace Figures 5-18 and 5-10 with Figures 7-7 and 7-8.

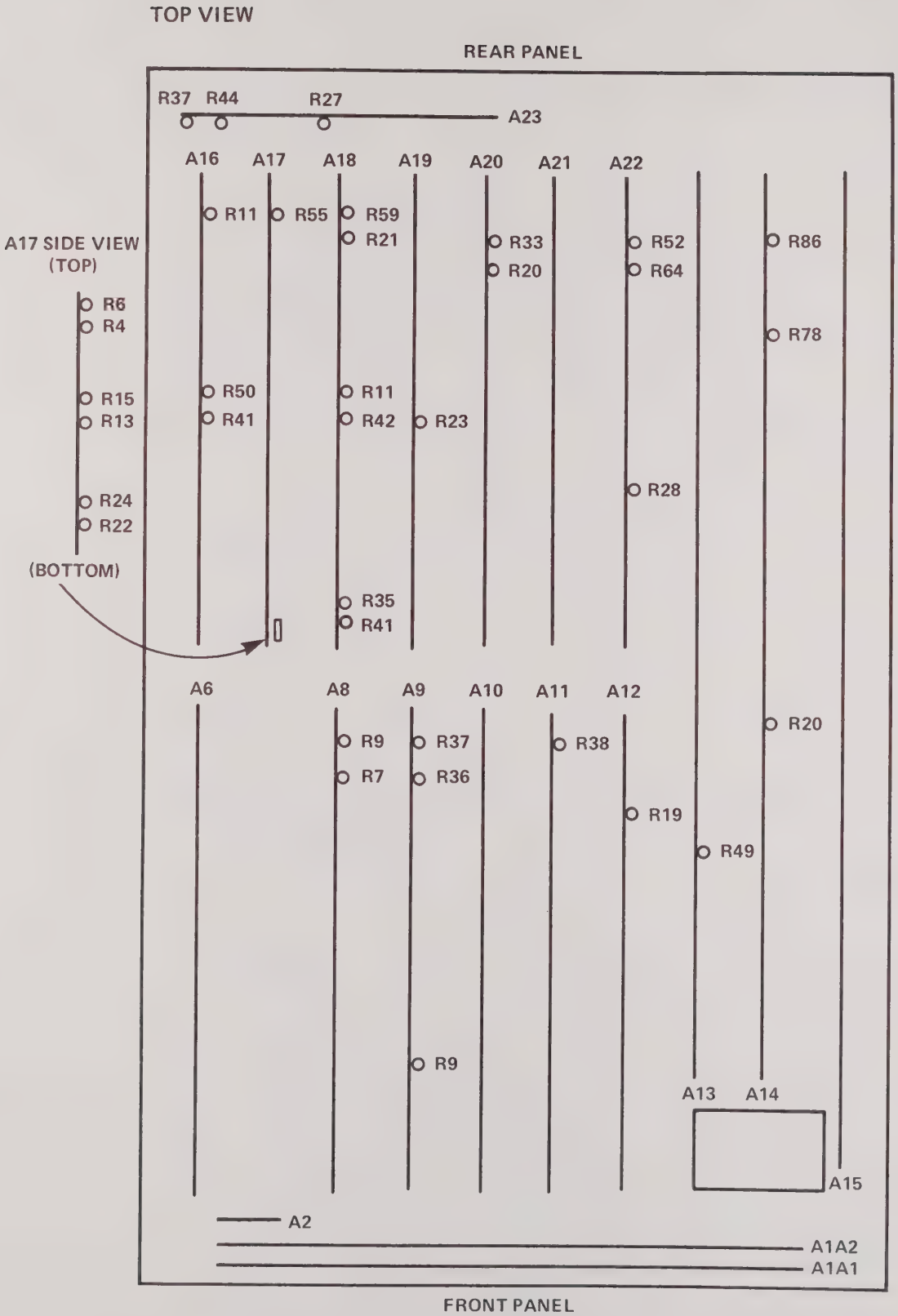


Figure 7-7. Adjustment Locations, Standard Instrument (with Phase Jitter)

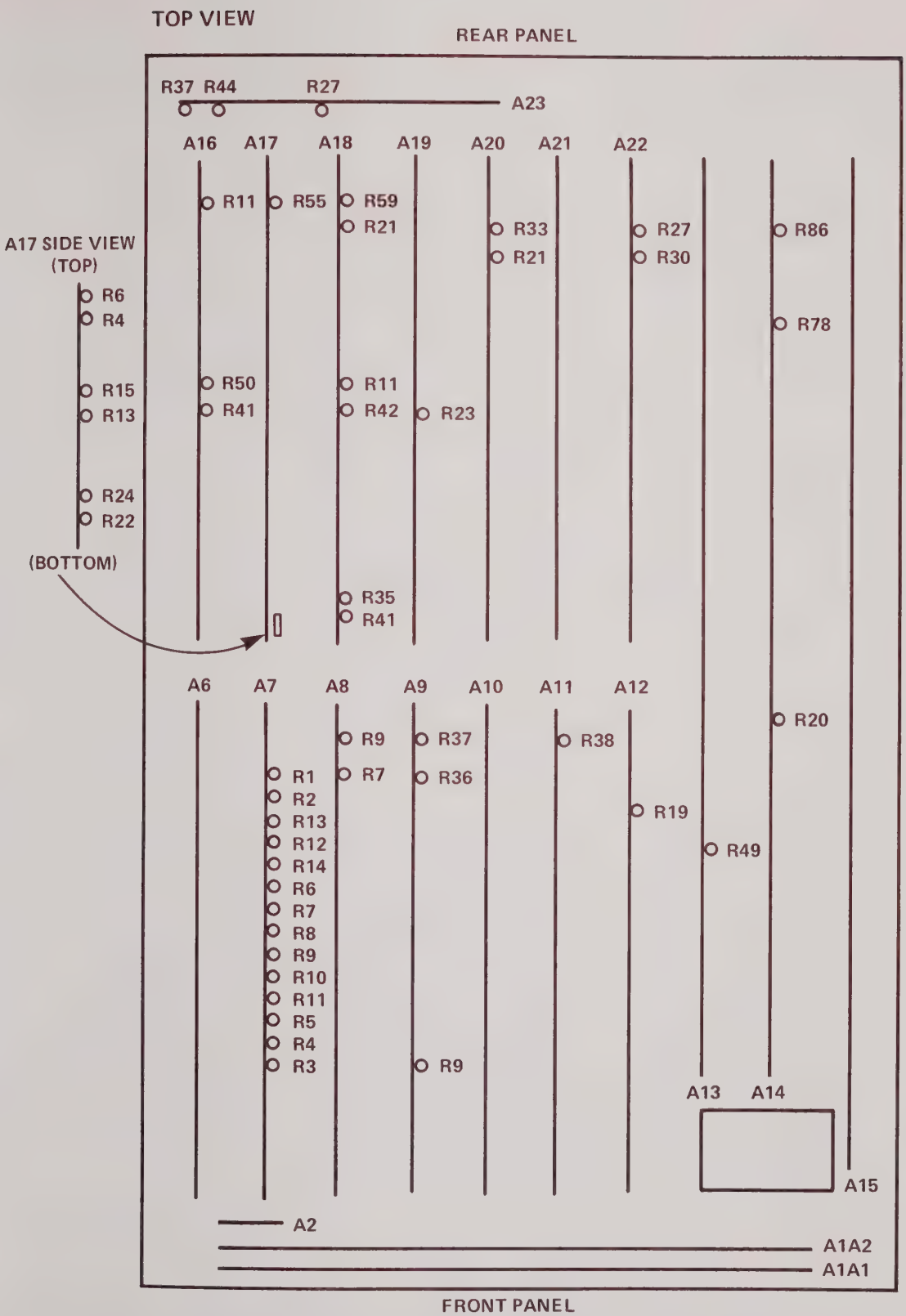


Figure 7-8. Adjustment Locations, Option 012 Instrument (with Nonlinear Distortion)

P/O Change 7

Page 6-33, 6-34, Table 6-3:

Replace A20 parts list with Table 7-1.

Table 7-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20	04943-60020 M	1	ANALOG OUTPUTS PC BOARD ASSEMBLY	28480	04943-60020
A20C2	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C3	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C4	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C5	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C6	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C7	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C8	0160-2264 2	2	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A20C9	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C10	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C11	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C12	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C13	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C14	0160-2264 2		CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A20C15	0180-0374 3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A20C16	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C17	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C18	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C19	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C20	0160-2201 7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A20C21	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C22	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C23	0160-2213 1		CAPACITOR-FXD 620PF +-5% 300VDC MICA	28480	0160-2213
A20C24	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C25	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C26	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C27	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C28	0180-0228 6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A20C29	0160-4137 2		CAPACITOR-FXD .01UF +-1% 100VDC POLYSTY	84411	863UW
A20C30	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C31	0160-0576 5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20CR1	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20CR2	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20J1	1251-4399 2		CONNECTOR 8-PIN M POST TYPE	28480	1251-4399
A20J2	1251-4399 2		CONNECTOR 8-PIN M POST TYPE	28480	1251-4399
A20MP1	0403-0239 3		EXTRACTOR-PC BOARD YEL NYL .062-BD-THKNS	28480	0403-0239
A20Q1	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A20Q2	1855-0062 8	2	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A20Q3	1854-0071 7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A20R1	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R2	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R3	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R4	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R5	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R6	1810-0151 2	1	NETWORK-RES 7-PIN-SIP .15-PIN-SPCG	28480	1810-0151
A20R7	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R8	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R9	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R10	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R11	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R12	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R13	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R14	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R15	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R16	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R17	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R18	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R19	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R20	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R21	2100-3065 5		RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	02111	43P201
A20R22	0757-0422 5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A20R23	0757-0279 0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R24	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R25	0757-0438 3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F

Table 7-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20R26	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A20R27	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R28	0698-3157 3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A20R29	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R30	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R31	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R32	0698-3453 2		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A20R33	2100-3161 6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A20R34	0698-3243 8		RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1783-F
A20R35	0757-0280 3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R36	0757-0465 6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A20R37	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R38	0757-0442 9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20TP1	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A20TP2	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A20TP3	0360-0124 3		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A20U1	1818-0342 9	2	IC P2101A-4 1K RAM NMOS	34649	P2101A-4
A20U2	1818-0342 9		IC P2101A-4 1K RAM NMOS	34649	P2101A-4
A20U3	1826-0430 3	1	IC CONV (A/D/A) 10-DIP-C	24355	AD559KD
A20U4	04943-80001 3	1	ROM, 128 X 8	28480	04943-80001
A20U5	1820-1419 8	2	IC COMPTR TTL LS MAGTD 4-BIT	01295	SN74LS85N
A20U6	1820-1419 8		IC COMPTR TTL LS MAGTD 4-BIT	01295	SN74LS85N
A20U7	1820-0937 3	1	IC CNTR CMOS BIN SYNCHRO NEG-EDGE-TRIG	01928	CD4040AF
A20U8	1820-1201 6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A20U9	1826-0188 8	2	IC CONV CMOS* D/A 8-BIT	04713	MC1408L-8
A20U10	1826-0188 8		IC CONV CMOS* D/A 8-BIT	04713	MC1408L-8
A20U11	1820-1208 3	2	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A20U12	1820-1203 8	3	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A20U13	1820-1693 0		IC LCM CMOS D-TYPE DUAL 4-BIT	04713	MC145088CL
A20U14	1820-1693 0		IC LCM CMOS D-TYPE DUAL 4-BIT	04713	MC145088CL
A20U15	1820-1693 0		IC LCM CMOS D-TYPE DUAL 4-BIT	04713	MC145088CL
A20U16	1826-0208 3	2	IC OP AMP 8-DIP-P	27014	LM310N
A20U17	1826-0089 8	1	IC 2525 OP AMP TO-99	29832	1322
A20U18	1820-1195 7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A20U19	1820-1918 2		IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS241N
A20U20	1820-1199 1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A20U21	1826-0065 0		IC 311 COMPARATOR 8-DIP-P	01295	SN72311P
A20U22	1820-1197 9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A20U23	1820-1251 6	1	IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A20U24	1820-1491 6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A20U25	1826-0217 4	1	IC OP AMP TO-99	07933	RC4558T
A20U26	1826-0319 7	1	IC OP AMP TO-99	27014	LF356H
A20XU1	1200-0668 3	2	SOCKET-IC 22-CONT DIP DIP-SLDR	82647	C932202
A20XU2	1200-0668 3		SOCKET-IC 22-CONT DIP DIP-SLDR	82647	C932202
A20XU13	1200-0431 8		SOCKET-IC 24-CONT	28480	1200-0431
A20XU14	1200-0431 8		SOCKET-IC 24-CONT	28480	1200-0431
A20XU15	1200-0431 8		SOCKET-IC 24-CONT	28480	1200-0431

P/O Change 7

Page 8-102, Figure 8-66:

Replace with Figure 7-8 of this change.

Page 8-103, Figure 8-67:

Replace with Figure 7-9 of this change.

Delete A20 Principles of Operations, A20 Block Diagram and Troubleshooting from A20 Section VIII of manual.

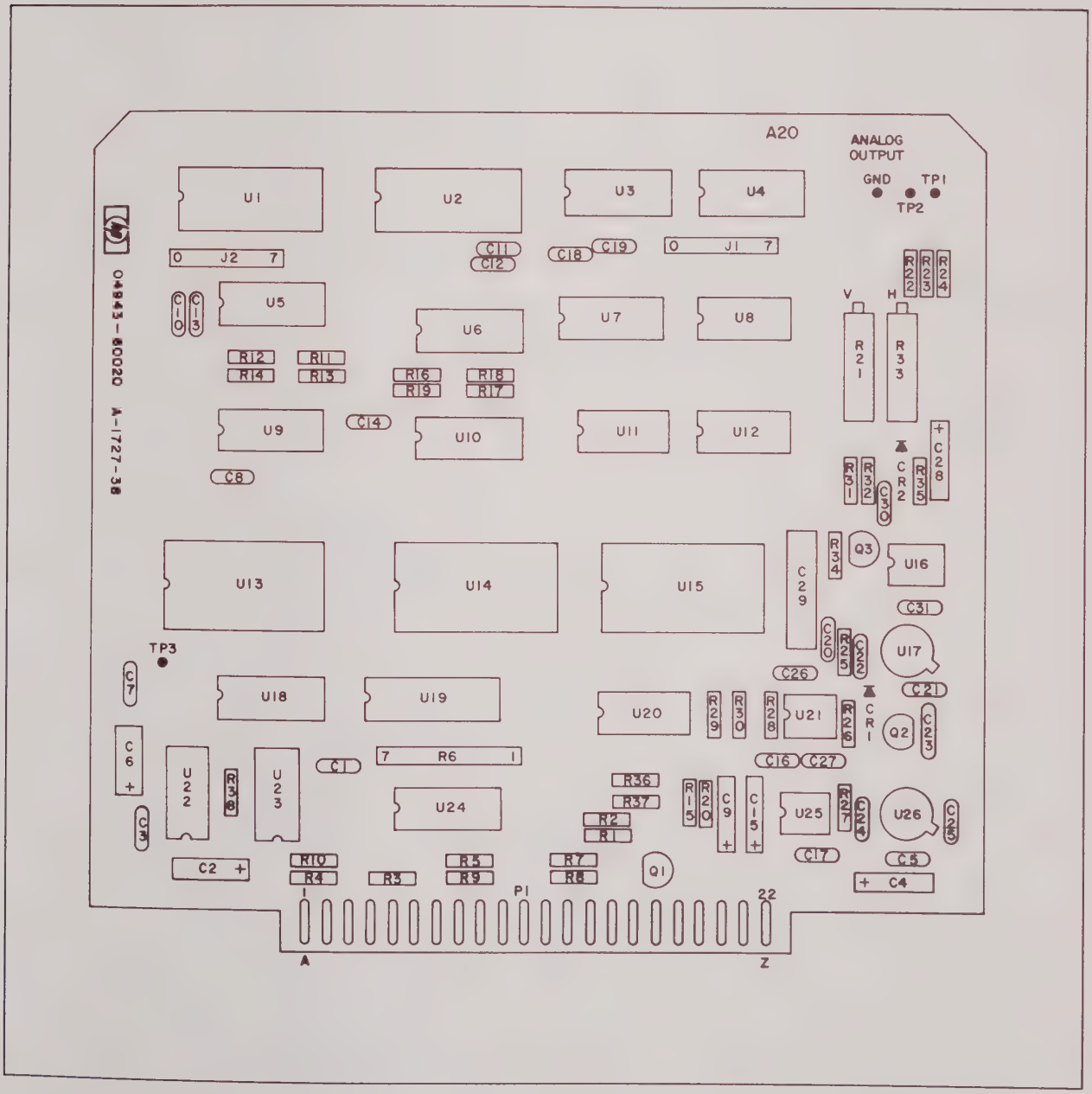


Figure 7-9. A20 Analog Outputs Component Locator

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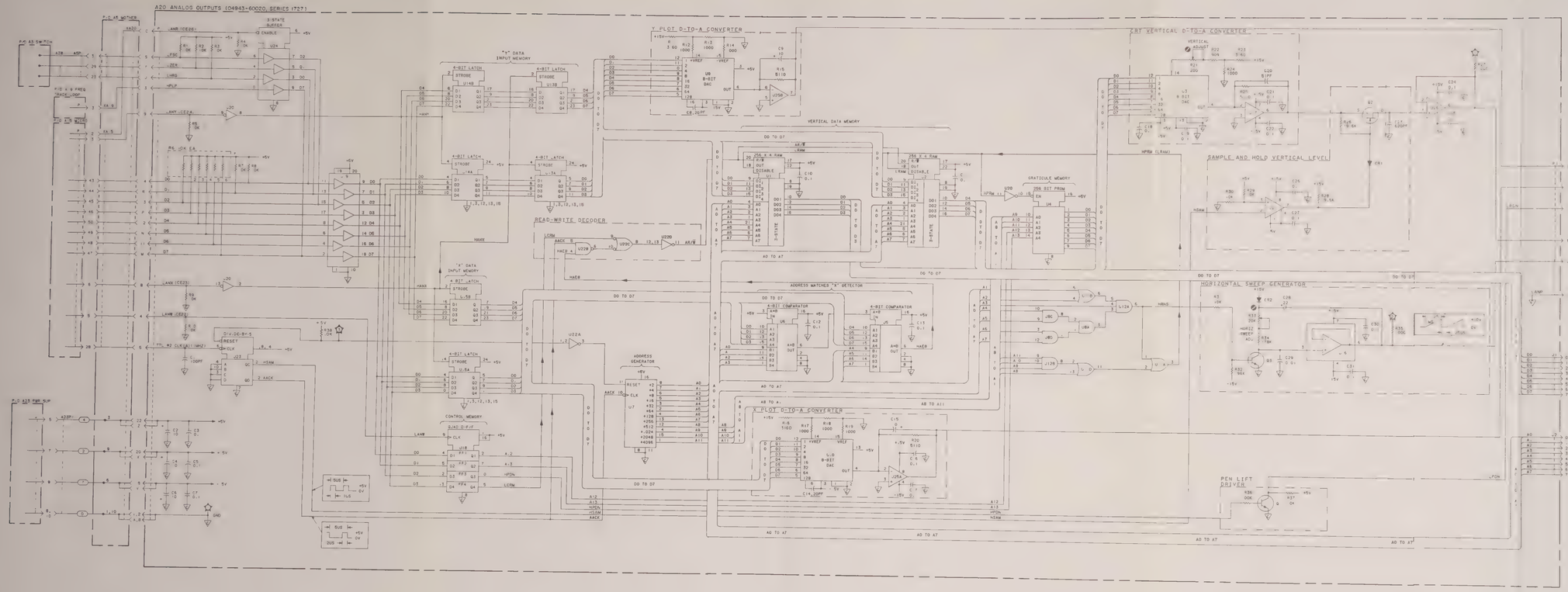


Figure 7-10. A20 Analog Outputs Schematic Diagram

CHANGE NO. 8

Page 8-62, Figure 8-38:

Change A8 date-code to 1910

Page 8-63, Figure 8-39:

Make changes to Phase-Locked-Loop circuit as shown in partial schematic of Figure 7-11.

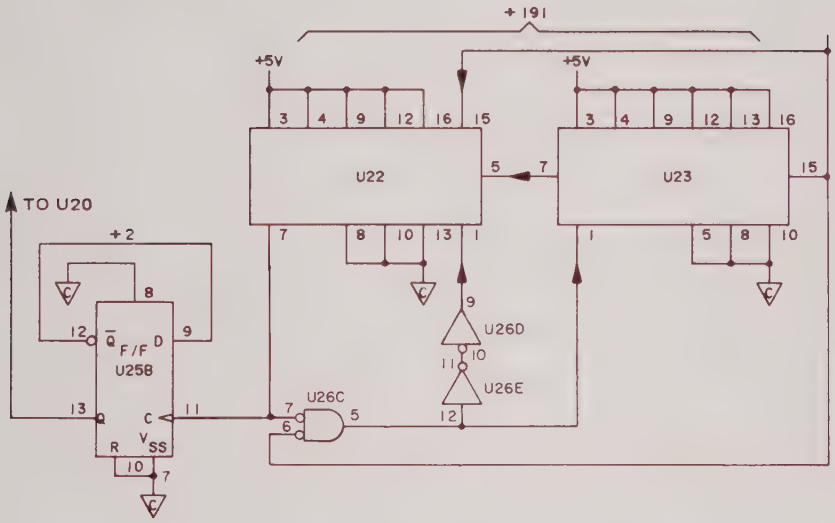


Figure 7-11.

Change A8 Schematic Series to 1910.

CHANGE NO. 9

Page 8-62, Figure 8-38:

Change A8 date-code to 1741

Page 8-63, Figure 8-39:

Change A8R12 to 17.8K
A8R13 to 10K
A8R31 to 9.09K

Change A8 Schematic Series to 1741

Page 6-13, Table 6-3:

Change: A8R12 to 0757-0199, Resistor 21.5K; Mfr. Code 24546; Mfr. Part No. C4-1/8-T0-2152-F
A8R13 to 0757-0444, Resistor 12.1K, Mfr. Code 24546; Mfr. Part No. C4-1/8-T0-1212-F
A8R31 to 0757-0442, Resistor 10K, Mfr. Code 24546; Mfr. Part No. C4-1/8-T0-1002-F

CHANGE 10

Page 6-28, Table 6-3:
Change A17R43 from 1810-0262 to 1810-0245.
Page 6-29, Table 6-3;
Delete A17XU16.
No other changes are needed; components are electrically the same.

End of Change 10

CHANGE 11

Page 6-26, Table 6-3:
Delete 0360-0127, Qty 7, Solder Terminal.
Page 8-90, Figure 8-54, A15 Component Locator:
Change date-code from 1928 to 1727.
Page 8-91, Figure 8-55, A15 Schematic:
Change series number from 1928 to 1727.

End of Change 11

CHANGE 12

Page 8-90, Figure 8-54, A15 Component Locator:
Change date-code from 1935 to 1928;
Page 8-91, Figure 8-55, A15 Schematic:
Change series number from 1935 to 1928.
No electrical changes are needed.

End of Change 12

CHANGE 13

Page 6-25, Table 6-3:
Change A15U28 from 1818-0751 to 1818-0397.
Page 8-90, Figure 8-54, A15 Component Locator:
Change date-code from 1944 to 1935.
Page 8-91, Figure 8-55 (1 of 2):
Change schematic series number from 1944 to 1935.

End of Change 13

CHANGE 14

Page 6-28, Table 6-3:
Change A17R47 from 0757-0444 to 0757-0442, Resistor 10K, 1%
Page 6-29, Table 6-3:
Delete A17R56-58
Page 8-96, Figure 8-59, A17 Component Locator:
Change date-code from B-1937 to A-1727.
Delete R56, R57, R58
Page 8-97, Figure 8-60, A17 Schematic:
Change R47 from 12K to 10K
Delete R56, R57, R58
Change series number from 1937 to 1727.

CHANGE 15

Page 8-90, Figure 8-54, A15 Component Locator:
Change date-code from B-1951 to A-1944.
Page 8-91, Figure 8-55, A15 Schematic:
Change series number from B-1951 to A-1944.
No component changes needed.

CHANGE 16

Page 6-2, Table 6-1:
- Change A3 Part No. from 04943-60124 to 04943-60003.
- Change A3 (Opt. 012) Part No. from 04943-60128 to 04943-60505.
- Change A5 Part No. from 04943-60125 to 04943-60005.
- Change A6 Part No. from 04943-60126 to 04943-60006.
- Change A17 Part No. from 04943-60127 to 04943-60017.

Page 6-7, Table 6-3:
- Change A3 from 04943-60124, Check Digit 9, to 04943-60003, Check Digit 3.
- Change A3 (Opt 012) from 04943-60128, Check Digit 3, to 04943-60505, Check Digit 0.

Page 6-8, Table 6-3:
- Change A5 from 0493-60125, Check Digit 0, to 04943-60005, Check Digit 5.
- Change A5J2 from 1250-0257, Check Digit 3, to 1250-1449, Check Digit 5.

Page 6-9, Table 6-3:
- Change A6 from 04943-60126, Check Digit 1, to 04943-60006, Check Digit 6.
- Change A6J2 from 1250-0257, Check Digit 3, to 1250-1449, Check Digit 5.

Page 6-29, Table 6-3:
- Change A17W1 from 5060-7155, Check Digit 3, to 04942-60050, Check Digit 9.

Page 8-52, Figure 8-29, A3 Component Locator:
- Change HP Part No. from 04943-60124 to 04943-60003.
- Change date-code from B-2004 to A-1727.

Page 8-53, Figure 8-30, A2 and A3 Schematic:
- Change HP Part No. from 04943-60124 series 2004 to 04943-60003 series 1727.

Page 8-56, Figure 8-32, A5 Component Locator.
- Change HP Part No. from 04943-60125 Series B-2004 to 04943-60005 Series A-1727.

Page 8-57, Figure 8-33, A5 Schematic:
- Change HP Part No. from 04943-60125 series 2004 to 24943-60005 series 1727.

Page 8-58, Figure 8-34, A6 Component Locator:
- Change HP Part No. from 04943-60126 series C-2004 to 04943-60008 series B-1826.

Page 8-59, Figure 8-35, A6 Schematic:
- Change HP Part No. from 04943-60126 series 2004 to 04943-60006 series 1826.

Page 8-96, Figure 8-59, A17 Component Locator:
- Change HP Part No. from 04943-60127 series C-2004 to 04943-60017 series B-1937.

Page 8-97, Figure 8-60, A17 Schematic:
- Change HP Part No. from 04943-60127 series 2004 to 04943-60017 series 1937.
- Change serial number prefix on title page, from 2015A to 1731A.

End of Change 16.

CHANGE 17

Page 5-29, Figure 5-19:
Replace R32 with R30

Page 6-24, Table 6-3:
A14U15 change part number 1820-1434 to 1820-1420

Page 6-24, Table 6-3:
A14U19 change part number 1820-1420 to 1820-1122
Change quantity of 1 to 2

Page 6-45, Table 6-3, Item 6:
Change Part Number 1390-0088 to 1390-0257
Change quantity of 4 to 8

Page 8-76, Figure 8-52:
Change date-code from G2004-38 to F1837-38

Page 8-77, Figure 8-52, A14 Envelope Delay Schematic:
Change 83-1/3 Hz Reference Generator as shown in partial schematic of Figure 8-52

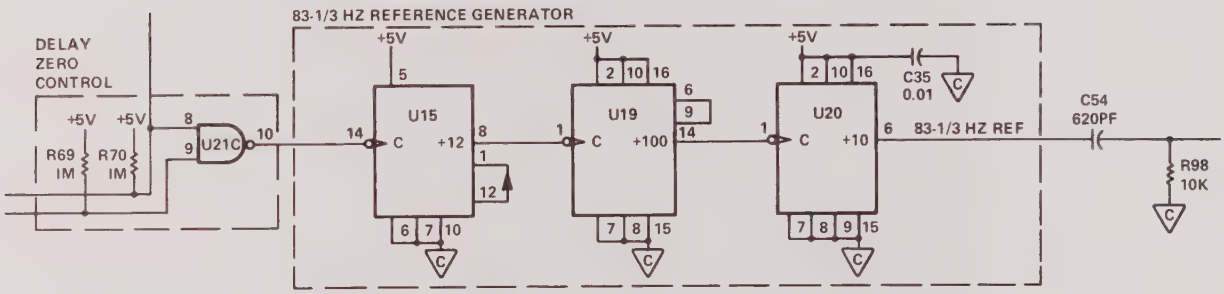


Figure 8-52.

Page 5-23, Section 5-29 Impulse Noise Count Rate Adjustment:
Change step 3 of Procedure to read:

3. Select a value for A18R51 to give 70 ±2 COUNTS. The list below gives the recommended resistor values to select.

NOTE: A bigger resistor gives less counts; a smaller resistor gives more counts.

Resistor Value	HP Part Number
576K	0698-7803
590K (Nominal value)	0698-8343
604K	0698-8344

If the above resistor selection will not put the COUNTS into range, then replace A18U11, the 143mS timer, and/or A18C28.

SECTION VIII
SERVICE

8.1. INTRODUCTION

8-2. This section contains service information for the Model 4943A Transmission Impairment Measuring Set. Included are troubleshooting hints, troubleshooting techniques, mechanical access, and theory of operation.

8-3. SAFETY CONSIDERATIONS

8-4. The following precautions should be taken to insure against serviceperson injury and instrument damage:

a. Remove ac power from the instrument when hooking up test equipment or test fixtures, when removing/installing instrument covers, when removing/installing PC boards or any other suspected malfunctioning component.

b. Use a properly grounded 3-wire receptacle for the instrument's power cord.

WARNING

The service procedures described in this section are performed with power supplied to the instrument, and protective covers removed. These procedures should be performed only by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock).

c. Plan and think through your repair actions before you perform them.

8-5. AFTER SERVICE PRODUCT SAFETY CHECKS

8-6. Visually inspect interior of instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy cause of any such condition.

8-7. Using a suitable ohmmeter, check resistance from instrument enclosure to ground pin on power cord plug. The reading must be less than one ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist.

8-8. Check any indicated front or rear panel ground terminals marked, using the above procedures.

8-9. Check resistance from instrument enclosure to line and neutral (tied together) with the power switch on and the power source disconnected. The minimum acceptable resistance is two megohms. Replace any component which results in a failure.

8-10. Check line fuse(s) to verify that a correctly rated fuse is installed.

8-11. GENERAL TROUBLESHOOTING HINTS

8-12. To isolate a fault in the 4943A, a large amount of information can be obtained from the front panel. If a problem occurs, it is important to find answers to the following questions:

a. Does the instrument work properly in any measurement? If so, which ones?

b. Can the problem be isolated to only the transmit mode — only the receive mode?

c. Can the problem be isolated to only the normal mode — only the self-check mode — only the master-slave mode?

8-13. SIGNATURE ANALYSIS AIDED TROUBLESHOOTING

8-14. Signature analysis is the technique of obtaining a unique and repeatable bit pattern at a circuit test point. Special test equipment is used to obtain a four digit alphanumeric display. The signatures of a properly functioning instrument are used to trace circuit operation.

8-15. The A15 Microprocessor Assembly has signature analysis capability built in. The flow charts of Figures 8-18 through 8-23 take advantage of using signatures to troubleshoot this board. Also provided are reference signature tables for this board. They are Tables 8-3 through 8-8, and are located next to the A15 schematic. The signatures in the tables differ sometimes with the flow charts. This difference is caused by different setup conditions.

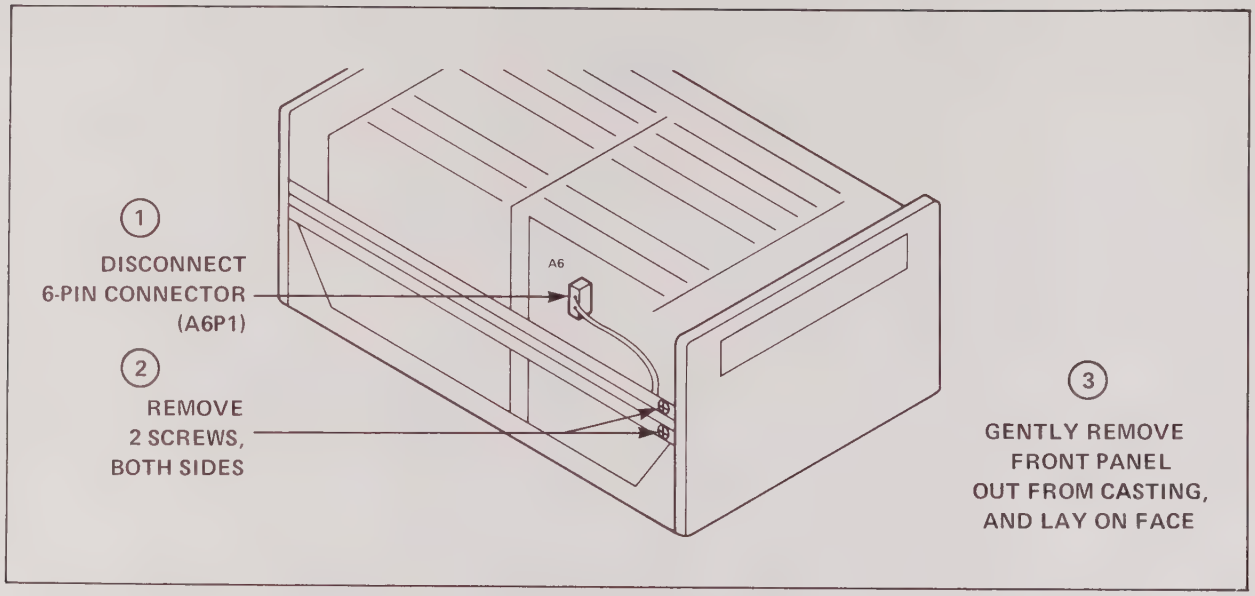


Figure 8-1. Front Panel Area Access

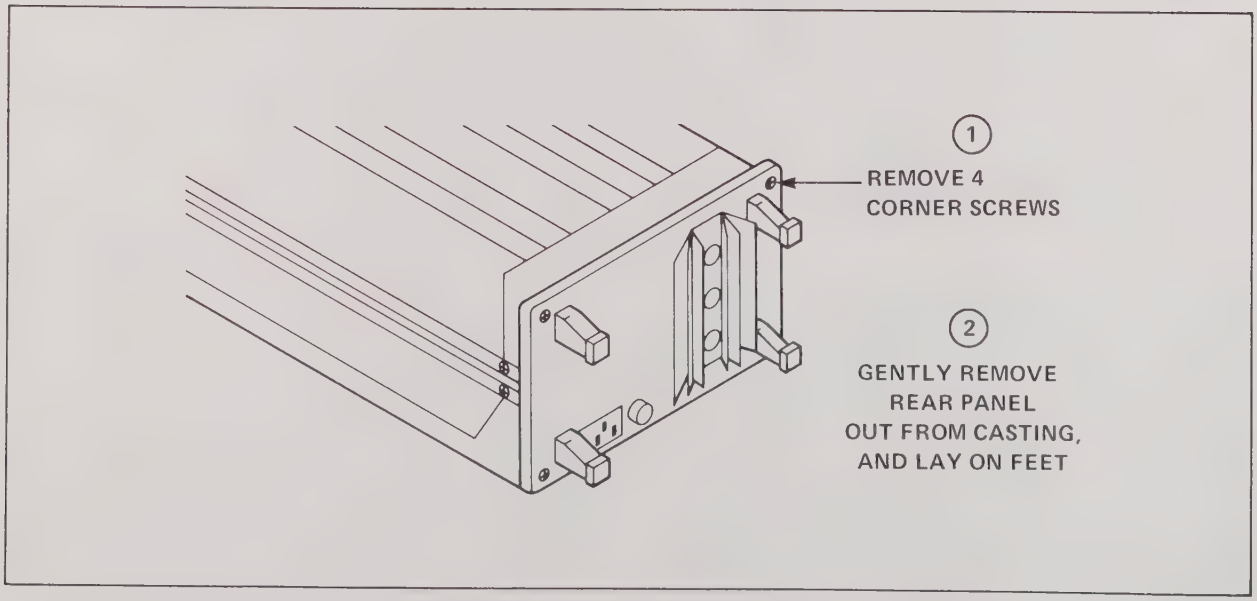


Figure 8-2. Rear Panel Area Access

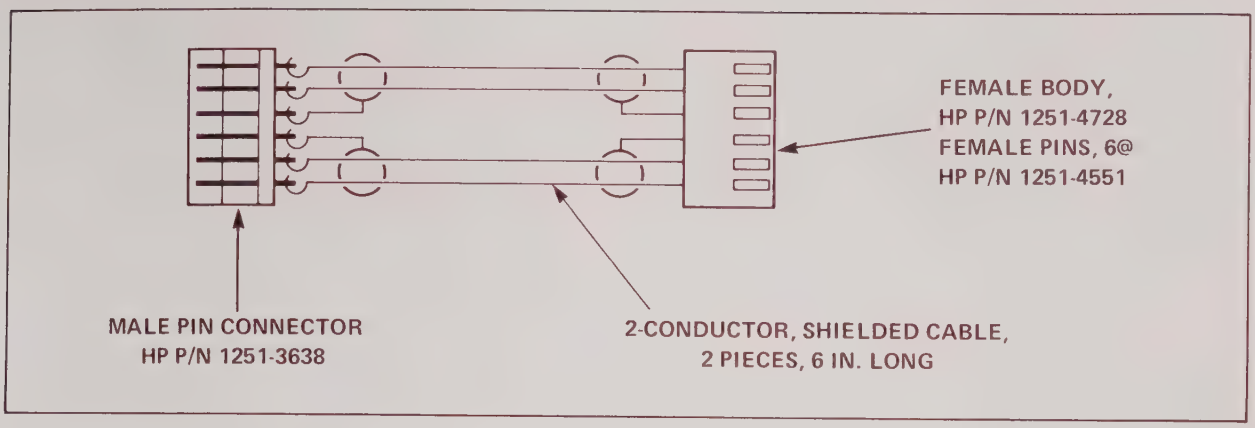


Figure 8-3. Test Lead Extension, Front Panel

8-16. MECHANICAL ACCESS AND DISASSEMBLY

8-17. Either top or bottom cover may be removed by turning their four twist-lock connectors 1/4 turn counterclockwise. Removing the top cover gives access to all plug-in PC board assemblies. Removing the bottom cover gives access to the connector pins of all the PC board assemblies. Pin numbers are labeled for test convenience.

8-18. Figure 8-1 shows how to gain access to the front panel area. Note that one connector must be disconnected before removing the front panel. The instrument may then be operated with the front panel removed from its mount and lying face down. However, since the disconnected cable is too short, the test lead extender in Figure 8-3 is needed. Improved operation will result if a ground wire jumper is added from front panel metal to chassis metal.

8-19. The rear panel area is accessible as shown in Figure 8-2. No test lead extenders are needed here, with the rear panel removed from its mount. If the HP-IB option is installed, the ribbon cable to the rear panel will need to be disconnected. Pull its connector off the small PC board at the HP-IB connector.

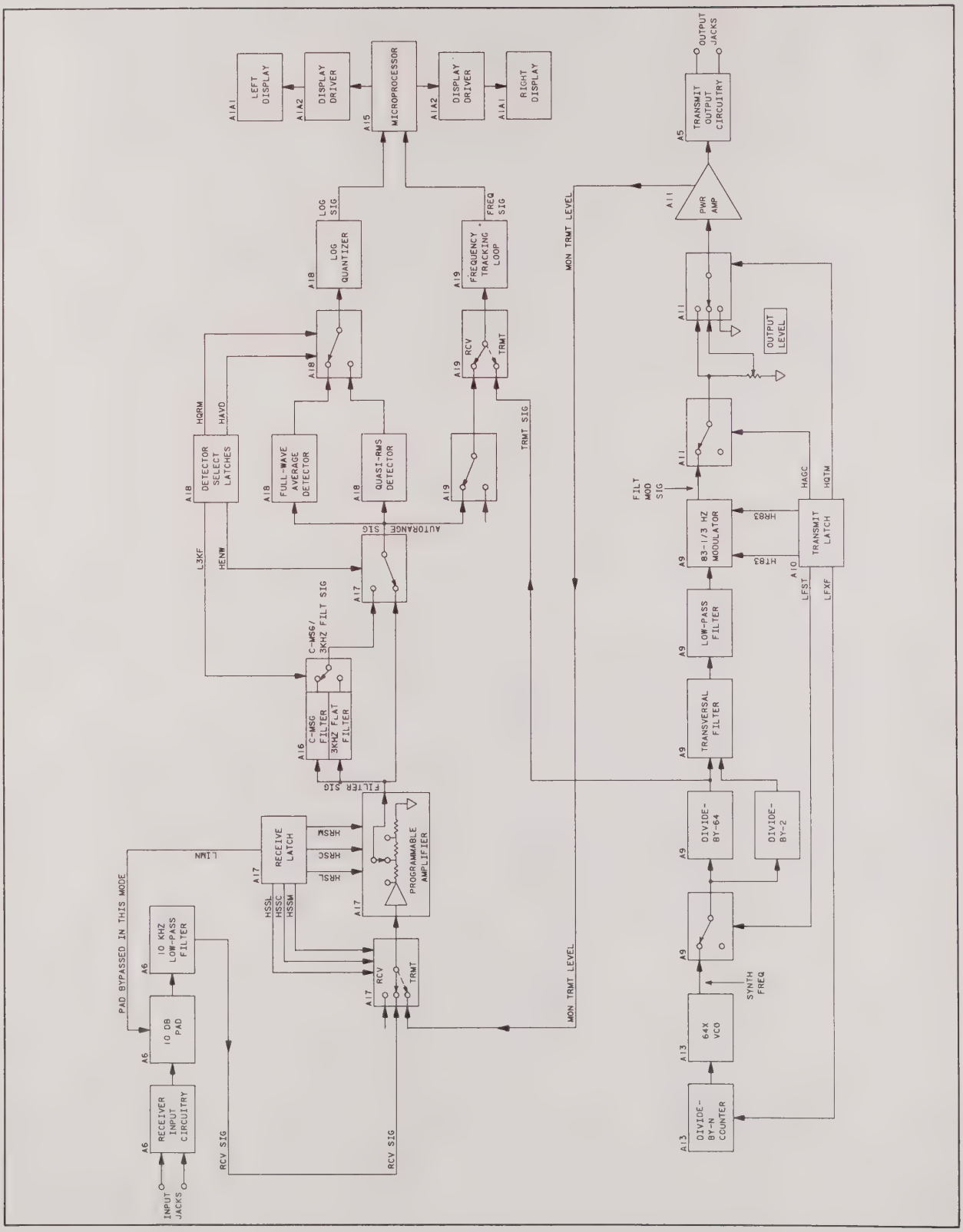


Figure 8-4. Level & Frequency Block Diagram

8-20. THEORY OF OPERATION

8-21. The following paragraphs describe the signal paths within the Model 4943A. A block diagram level discussion is used. No attempt is made to describe the principal of the measurement, since Section 3 of this manual covers that subject. The following description will therefore help the repair technician trace signals through the instrument. Each measurement is described; first the transmit function, then receive. At the end is a brief description of modem operation. The modem circuitry is used by the master and slave units to "talk" to each other.

8-22. LEVEL AND FREQUENCY, TRANSMIT MODE

8-23. The transmitter circuitry performs the function of a variable frequency, variable power sine wave oscillator. Figure 8-4 illustrates both transmit and receive functions.

8-24. At the lower left of the figure is the divide-by-N counter. This counter is an integral part of a phase locked loop for controlling the voltage controlled oscillator (VCO). The VCO operates at 64 times the eventual output frequency. The divide-by-N counter can be set up by either front panel control switches or the microprocessor. At turn-on, the processor sets the VCO to operate at 64,256 Hz (64 x 1004 Hz). The front panel controls may then be used to adjust the transmit frequency.

8-25. The VCO signal is divided by 2 and by 64 for application to the transversal filter. The transversal filter is in effect a digital filter for producing analog signals. Using a combination of properly timed digital pulses, the transversal filter produces a sine wave shaped waveform. The waveform contains discrete, intermediate steps. Since the discrete steps appear at 32 times the output frequency (the particular case of this circuit), they are easy to filter out using a low-pass filter. The transversal filter waveform appears opposite the A9 schematic in this manual.

8-26. The sine wave from the low-pass filter passes through the 83 Hz modulator (unmodulated) to the power amplifier on A11. This signal is transferred through impedance matching circuitry to the front panel TRMT-RCV jacks. The impedance matching circuitry also converts the unbalanced amplifier output to a balanced configuration.

8-27. The VCO frequency, divided by 64, is used to produce the actual transmit frequency for display purposes. This signal is routed to the frequency tracking loop. This circuitry contains a 32X VCO in a phase locked loop configuration. This 32 times multiplication in a controlled time constant loop gives a steady, flickerless frequency display. Circuitry, at the microprocessor, counts the frequency, divides by 32, and passes this data to the right display.

8-28. The power amplifier output signal on A11 is sampled to produce the output level display. The signal loops back around to the programmable amplifier for detection by the full-wave average detector. The detector output is converted to a pulse stream by the log quantizer. The log quantizer is in essence an A-to-D converter. A counter on the microprocessor assembly counts the pulses to measure the transmit level. The processor sends this information to the left display.

8-29. LEVEL AND FREQUENCY, RECEIVE MODE

8-30. The receiver circuitry performs the function of an average reading ac voltmeter. This circuitry is also shown in Figure 8-4. Both transmit and receive functions are shown here because of the shared circuitry.

8-31. The receiver input circuitry converts the balanced input signal to unbalanced with the proper impedance match. The 10 kHz low-pass filter removes any high frequency noise. The received signal is then processed by the programmable amplifier, average detector, and log quantizer for level display. The received signal takes a parallel path from the programmable amplifier to the frequency tracking loop. This signal is used for frequency display.

8-32. The programmable amplifier has an 80 dB dynamic range (−70 dBm to +10 dBm in Level and Frequency). The amplifier's output is tapped (or sampled) in 10 dB steps, to keep the output within the range of the log quantizer. The programming instructions originate from the microprocessor according to the overrange or underrange condition of the log quantizer. So to produce a level display, the microprocessor considers the log quantizer output along with the selected 10 dB "window" of the programmable amplifier.

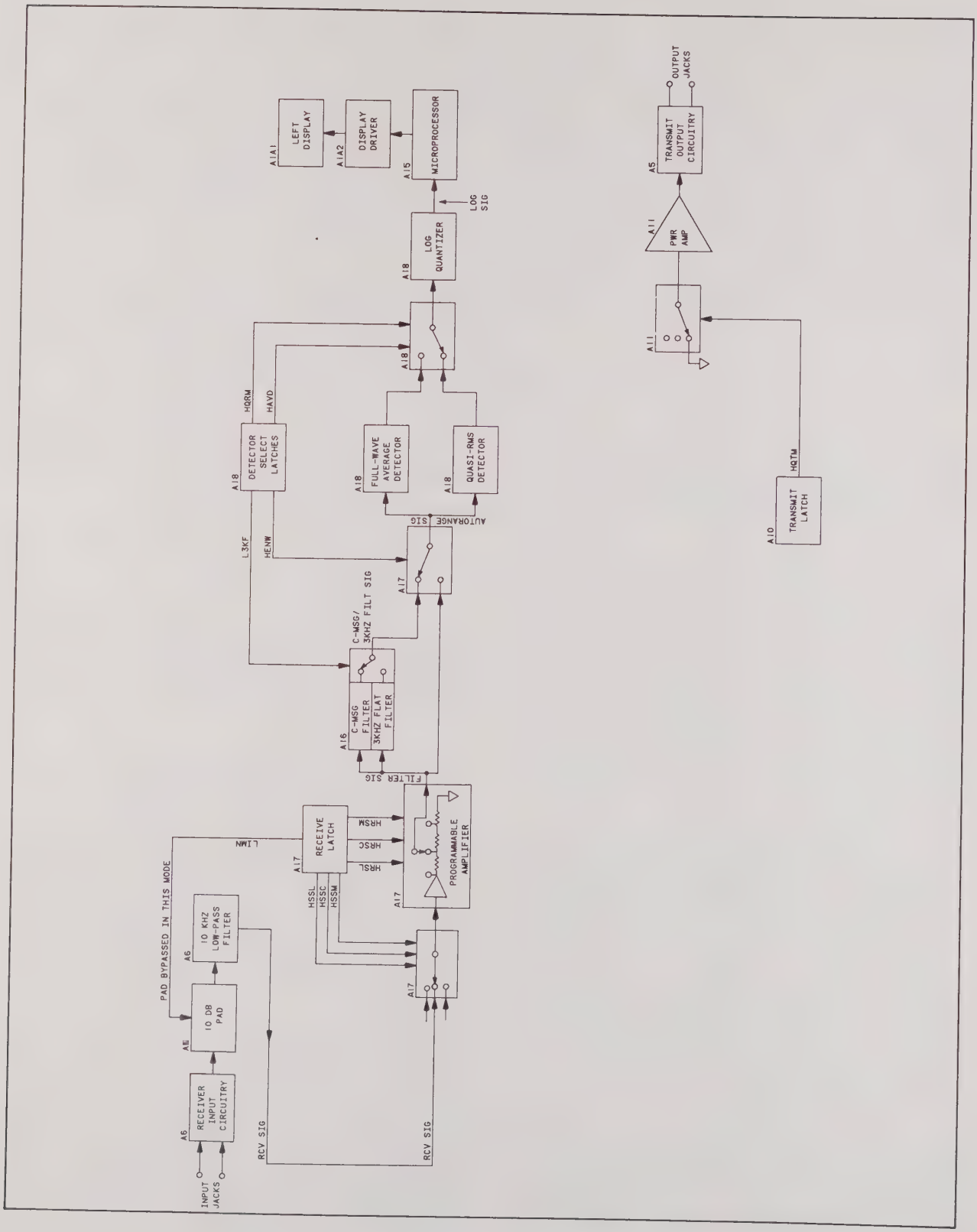


Figure 8-5. Message Circuit Noise Block Diagram

8-33. MESSAGE CIRCUIT NOISE, TRANSMIT MODE

8-34. The transmitter functions as a quiet termination for its end of the telephone circuit. A quiet termination is a simple resistive circuit, with no signal applied.

8-35. MESSAGE CIRCUIT NOISE, RECEIVE MODE

8-36. The receiver circuitry performs the function of a quasi-RMS ac voltmeter, with frequency weighting (C-message or 3 kHz flat). Figure 8-5 illustrates the receive function.

8-37. The receive circuitry for this measurement is similar to Level and Frequency except: (1) There is no frequency display since there is no frequency to receive, (2) a different level detector is used, and (3) a frequency weighting is used (C-message or 3 kHz low-pass filter). The quasi-RMS detector provides a detection response which closely approximates true RMS detection of the incoming noise signal.

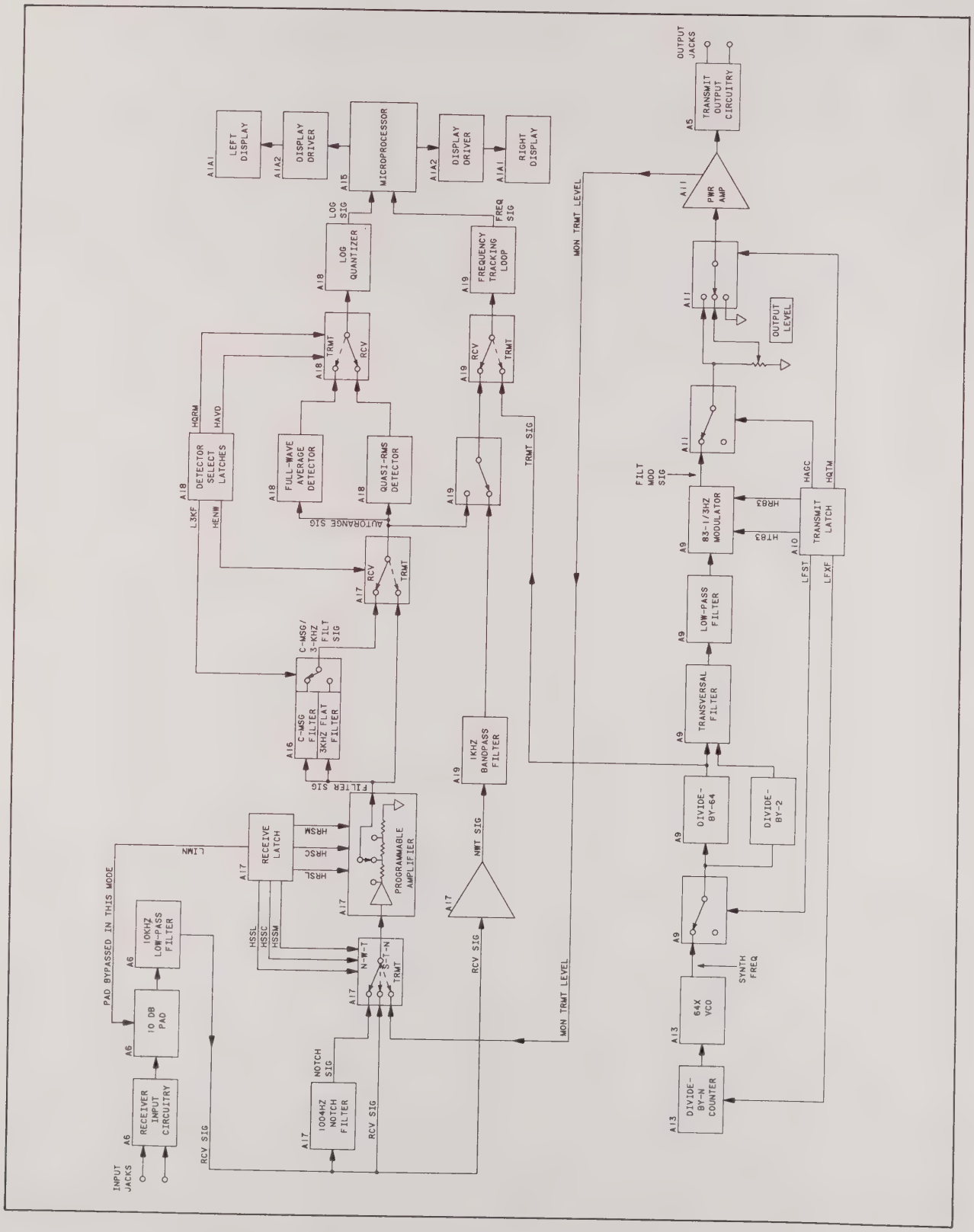


Figure 8-6. Noise-with-Tone and Signal-to-Noise Block Diagram

8-38. NOISE-WITH-TONE, TRANSMIT MODE

8-39. The transmitter circuitry functions as a fixed frequency, variable power sine wave oscillator. Figure 8-6 illustrates this measurement configuration.

8-40. The transmitter functions identically to the Level and Frequency transmitter with one exception: the transmit frequency is fixed at 1004 Hz. The frequency is fixed under microprocessor control.

8-41. NOISE-WITH-TONE, RECEIVE MODE

8-42. The receiver functions as a quasi-RMS ac voltmeter, with C-message (or 3 kHz flat) filtering and a 1004 Hz notch filter.

8-43. The 1004 Hz signal transmitted at the far end of the circuit allows the measurement of noise with a tone present on the complete circuit. To measure just the noise at the receive end, the tone must be removed before detection of the noise level. The 1004 Hz notch filter does this. All other received signal components (noise) pass through the filter for detection by the quasi-RMS detector.

8-44. To allow display of the received 1004 Hz frequency, the RCV SIG bypasses the programmable amplifier. The signal is buffered on A17 and goes to a 1004 Hz band-pass filter on A19. This signal may then be selected for application to the frequency tracking loop.

8-45. SIGNAL-TO-NOISE, TRANSMIT MODE

8-46. The transmitter circuitry functions as a fixed frequency, variable power sine wave oscillator. Figure 8-6 illustrates this measurement configuration. The transmitter is identical to the noise-with-tone mode with a fixed 1004 Hz signal.

8-47. SIGNAL-TO-NOISE, RECEIVE MODE

8-48. The receiver functions as a quasi-RMS ac voltmeter with C-message (or 3 kHz) filtering. The 1004 Hz notch filter is alternately switched in and out to obtain two measurement readings: (1) combined level of the 1004 Hz tone with noise, and (2) noise only. The microprocessor then compares these two received levels to derive the signal-plus-noise to noise value.

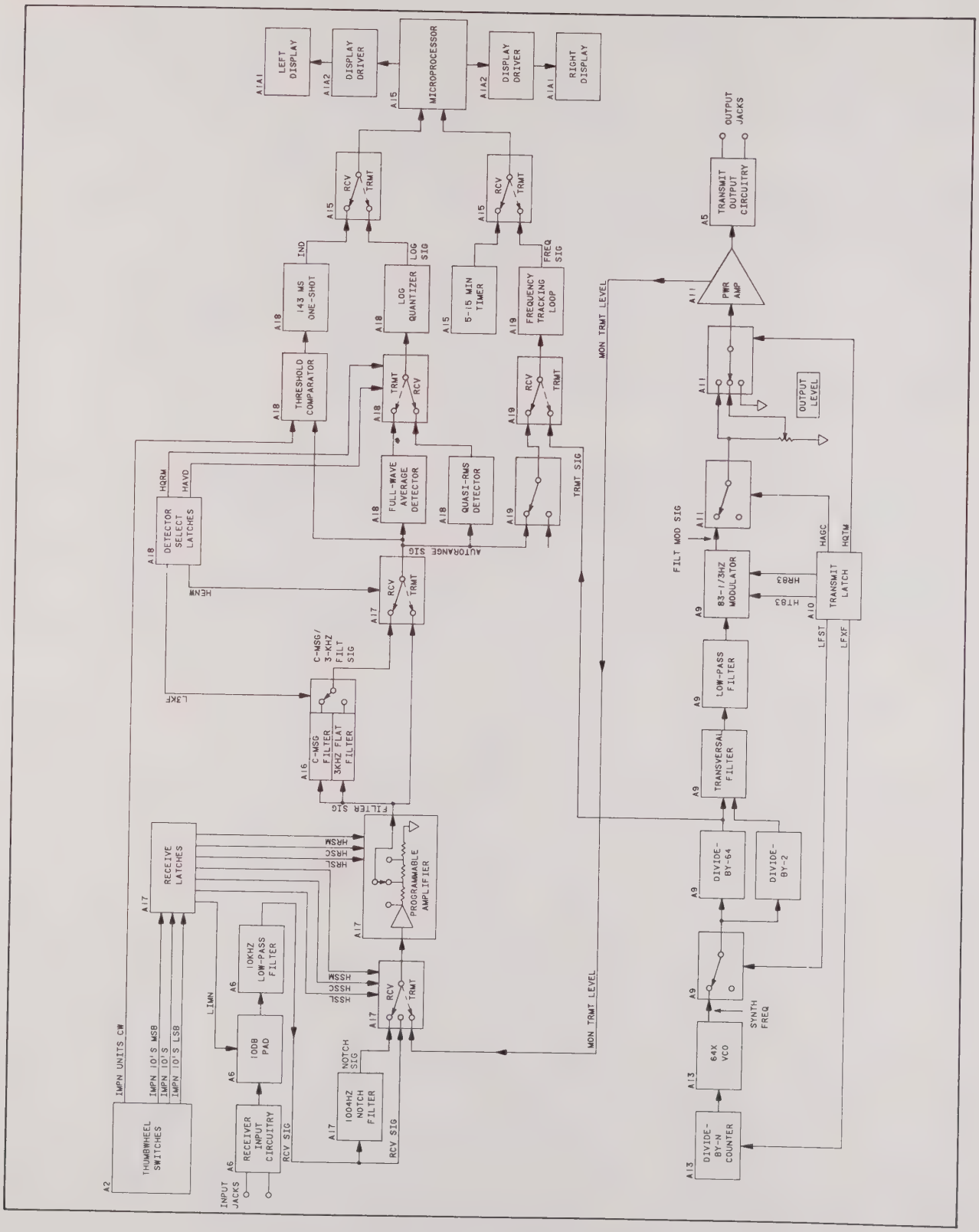


Figure 8-7. Impulse Noise Block Diagram

8-49. IMPULSE NOISE, TRANSMIT MODE

8-50. The transmitter functions as a fixed frequency (1004 Hz), variable power sine wave oscillator. Figure 8-7 illustrates this measurement configuration.

8-51. IMPULSE NOISE, RECEIVE MODE

8-52. The receiver functions as a noise spike totalizer, with threshold detection at a selectable level.

8-53. The received signal is attenuated by 10 dB on the A6 board (this is the only measurement using the 10 dB pad). The 1004 Hz notch filter removes the 1004 Hz tone from the incoming signal. The resultant signal (noise) is amplified by the programmable amplifier. The programmable amplifier does not autorange to a 10 dB window as in the Level and Frequency measurement. Instead, it performs a straight amplification (selectable in 10 dB steps) according to the setting of the IMPULSE NOISE thumbwheel switch (10's digit switch).

8-54. The programmable amplifier output signal is shaped by the selected noise filter for application to the threshold comparator. The threshold detection level is set by the IMPULSE NOISE thumbwheel switch (units digit switch). So out of the comparator is a squared pulse train, following the rate of the detectable impulse noise spikes. This pulse train is applied to a 143 mS one-shot. This one-shot limits the maximum count rate to 7 per second. The pulses from the one-shot are sent to the microprocessor board for counting and display.

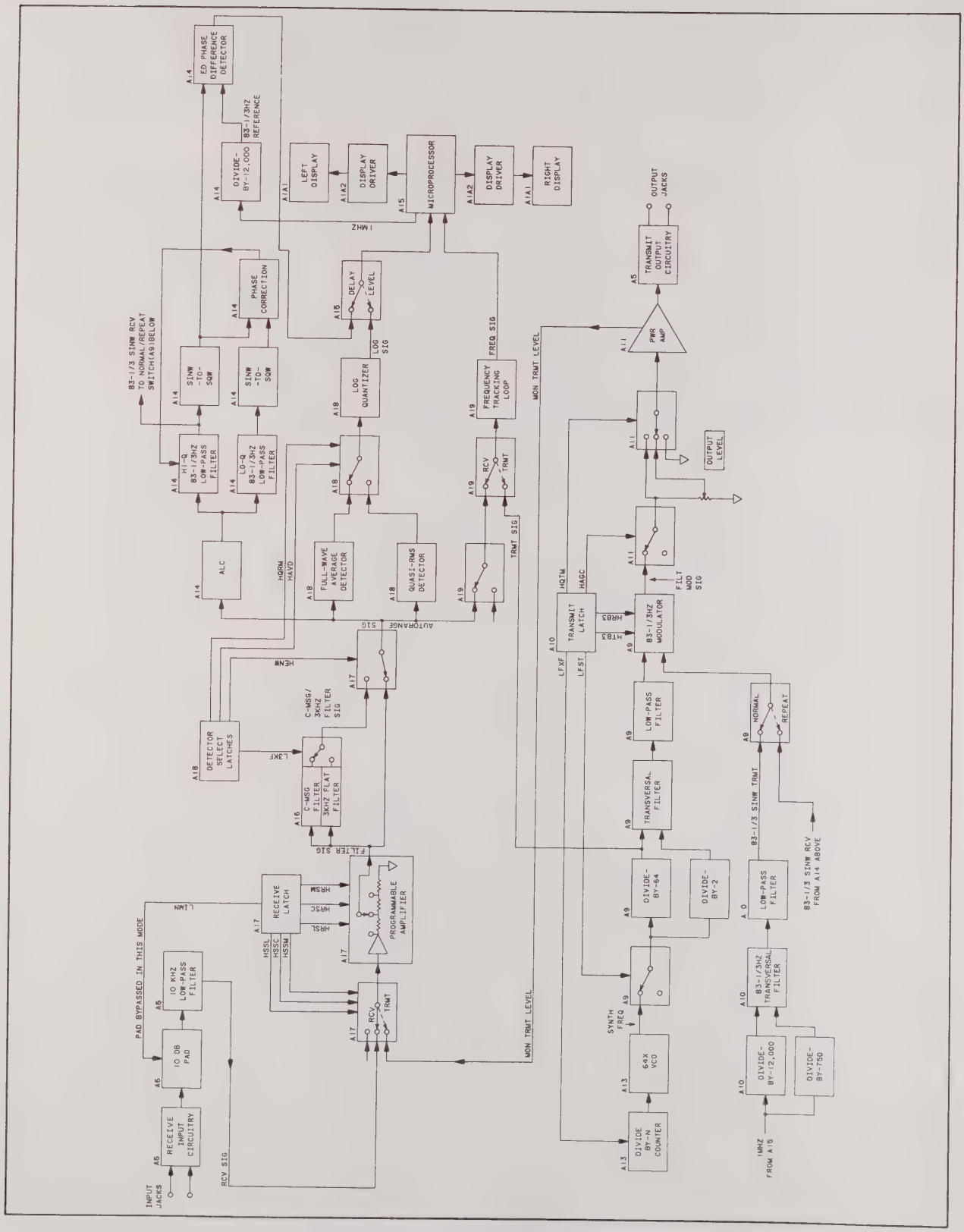


Figure 8-8. Envelope Delay Block Diagram

8-55. ENVELOPE DELAY, TRANSMIT MODE

8-56. The transmitter functions as a variable frequency, variable power AM (amplitude modulation) signal generator. The test signal produced is a variable carrier frequency (204 to 3904 Hz) with a fixed modulation frequency (83-1/3 Hz). Figure 8-8 illustrates this measurement.

8-57. The carrier frequency is derived in the same fashion as in the Level and Frequency measurement. This signal does, however, have 83-1/3 Hz amplitude modulation added at the A9 assembly. The 83-1/3 Hz signal originates from one of two sources, depending on whether the unit is operating in the normal or repeat mode.

8-58. If the normal mode is selected, the 83-1/3 Hz signal originates from the 1 MHz crystal controlled oscillator on the microprocessor assembly. The divide-by-12,000 and divide-by-750 circuitry produces the timing pulses for the 83-1/3 Hz transversal filter. A low-pass filter produces the proper sine-wave signal for application to the 83-1/3 Hz modulator.

8-59. If the repeat mode is selected, the 83-1/3 Hz signal is derived from the incoming received signal. The incoming signal comes through the input circuitry and programmable amplifier to the HI-Q 83-1/3 Hz low-pass filter. This filter selectivity passes the modulating signal for retransmission by the transmit circuitry.

8-60. ENVELOPE DELAY, RECEIVE MODE

8-61. The receiver functions as an AM demodulator and envelope delay comparator/calculator.

8-62. For received level display (at either the normal or repeat set), the full wave average detector is used. The log quantizer produces the pulse stream for application to the microprocessor assembly for counting.

8-63. For envelope delay detection and display at the normal set, a phase comparison is made. Both the received 83-1/3 Hz signal, and an internally generated 83-1/3 Hz reference, drive the envelope delay(ED) phase difference detector on the A14 assembly. This detector gates a 1 MHz clock. These gated pulse groups are then counted at the microprocessor assembly for envelope delay display.

8-64. The received signal at the output of the programmable amplifier goes to automatic level control circuitry (ALC) on A14. This presents a normalized signal level to two different 83-1/3 Hz low-pass filters. Since the HI-Q filter exhibits an unacceptable temperature characteristic (phase shift versus temperature), it needs compensation. The LO-Q filter exhibits less temperature dependency, and provides a reference signal for the HI-Q filter. This signal is used by the HI-Q filter to maintain a constant internal phase shift.

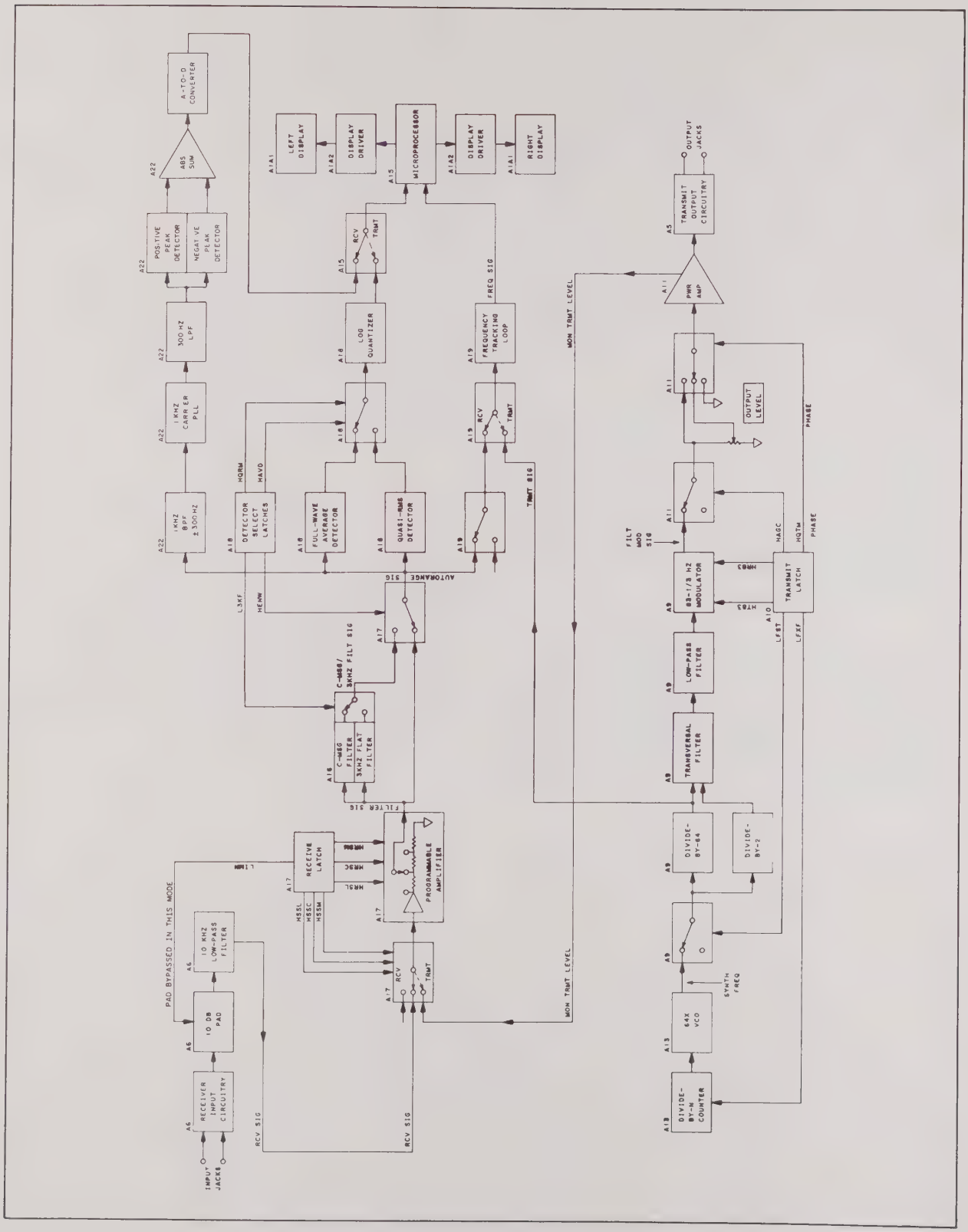


Figure 8-9. Phase Jitter Block Diagram

8-65. PHASE JITTER, TRANSMIT MODE

8-66. The transmitter functions as a fixed frequency (1004 Hz), variable power sine wave oscillator. Figure 8-9 illustrates this measurement configuration.

8-67. PHASE JITTER, RECEIVE MODE

8-68. The receiver performs the function of an FM (frequency modulation) detector. Detected modulating frequencies are limited to between 20 Hz and 300 Hz. The amplitude of the modulating excursions is limited to 30 degrees peak-to-peak, with reference to the 1004 Hz carrier.

8-69. The received signal from the programmable amplifier is routed to the phase jitter detector circuitry on A22. The primary element in the detector is a phase locked loop. This loop follows the incoming carrier frequency (1004 Hz), but has a slow lock-up time compared to the phase jitter component. The phase jitter signal now has a reference with which to compare. The measureable jitter appears as the phase error signal, between the incoming carrier and the loop reference. This jitter signal is filtered by a 300 Hz low-pass filter to remove the carrier. The frequency deviation component below 300 Hz passes through.

8-70. The peak-to-peak phase shift of the jitter signal is detected as a dc voltage. This voltage is proportional to the absolute difference between positive and negative phase peaks. An analog-to-digital converter creates a pulse whose width is proportional to the incoming dc voltage.

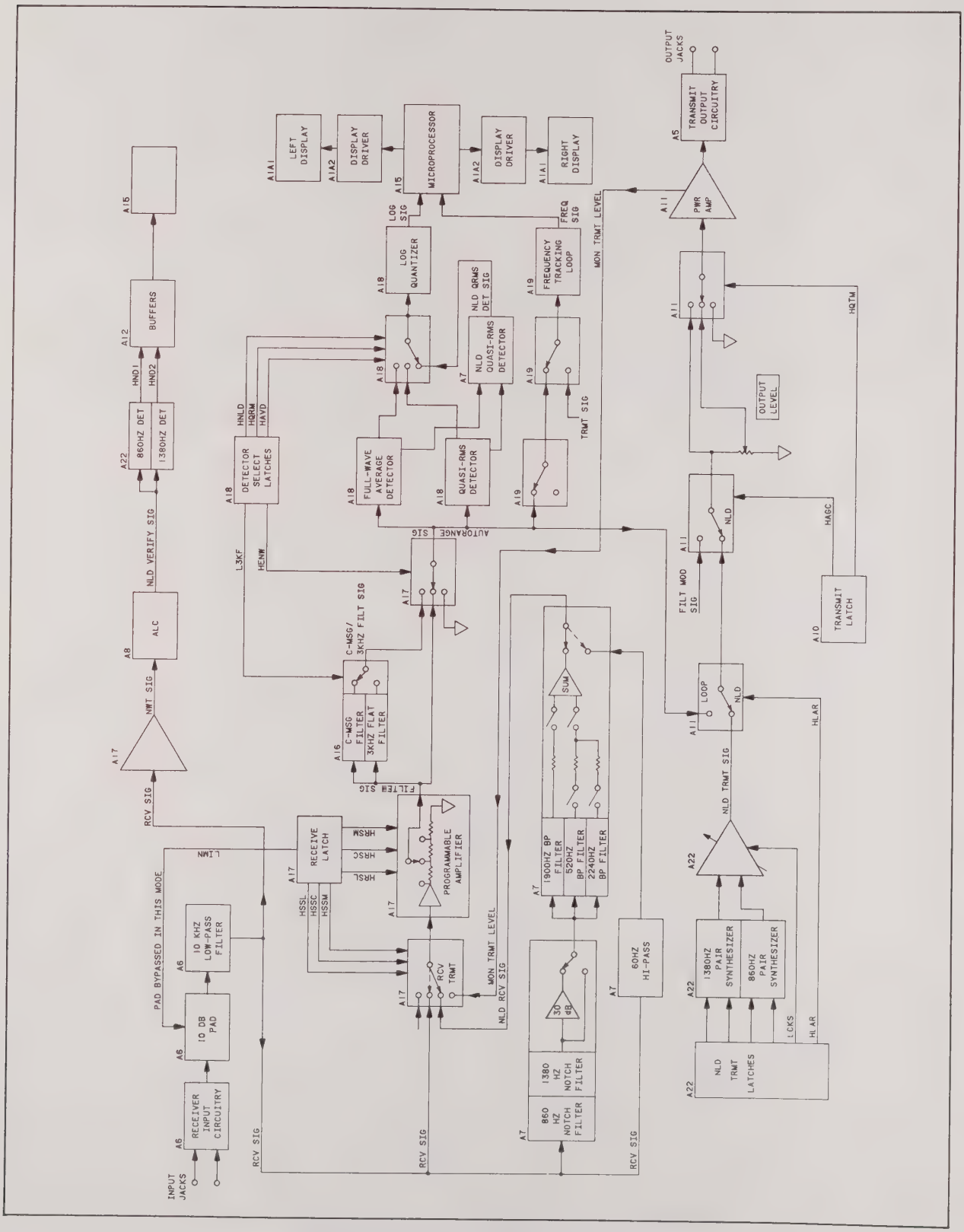


Figure 8-10. Nonlinear Distortion Block Diagram

8-71. NONLINEAR DISTORTION, TRANSMIT MODE (OPT 012)

8-72. The transmitter performs the function of a multiple frequency synthesizer, producing two frequency pairs. Figure 8-10 illustrates the transmit operation for this measurement mode.

8-73. The 1380 Hz and 860 Hz frequency pairs are synthesized from four crystal time based oscillators. The synthesized frequencies are added together for eventual transmission. During the check signal function, the 860 Hz pair synthesizer is shut down. The variable gain amplifier on A22 then doubles its gain to compensate power levels.

8-74. To provide for display of the transmitted output level, the NLD quasi-RMS detector is used. This detector derives its inputs from the average detector and the quasi-RMS detector. The response of the NLD detector is tailored to the NLD test signal. This detector provides an output whose amplitude closely approximates RMS values.

8-75. NONLINEAR DISTORTION, RECEIVE MODE (OPT 012)

8-76. The receiver performs the function of a frequency selective voltmeter. Figure 8-10 illustrates the receive operation of this measurement.

8-77. Reception of the 4 tone NLD test signal must be verified before beginning the NLD measurement. This assures that it is not noise that the measurement is proceeding on. The 860 Hz and 1380 Hz detectors on A22 perform this function. If a minimum signal level exists, these detectors signal the microprocessor. The microprocessor then continues program execution to the NLD measurement.

8-78. To begin the measurement, the power level of the total received signal must be found. To do this, the received signal is routed through a 60 Hz high-pass filter to the programmable amplifier. The amplifier output goes to the NLD quasi-RMS detector for level measurement. The 60 Hz high-pass filter is then ignored and the received signal is processed by other circuitry.

8-79. For the measurement of second and third order products, the received signal is routed to the 860 Hz and 1380 Hz notch filters. The notch filters attenuate the test tone pairs and pass the remaining intermodulation products. This signal goes to three separate band-pass filters for selection of the intermodulation products.

8-80. The outputs of the 520 Hz and 2240 Hz band-pass filters are summed for the measurement of second order distortion. The NLD quasi-RMS detector provides for the level measurement of this signal. The 1900 Hz band-pass filter is similarly selected for measurement of the third order product.

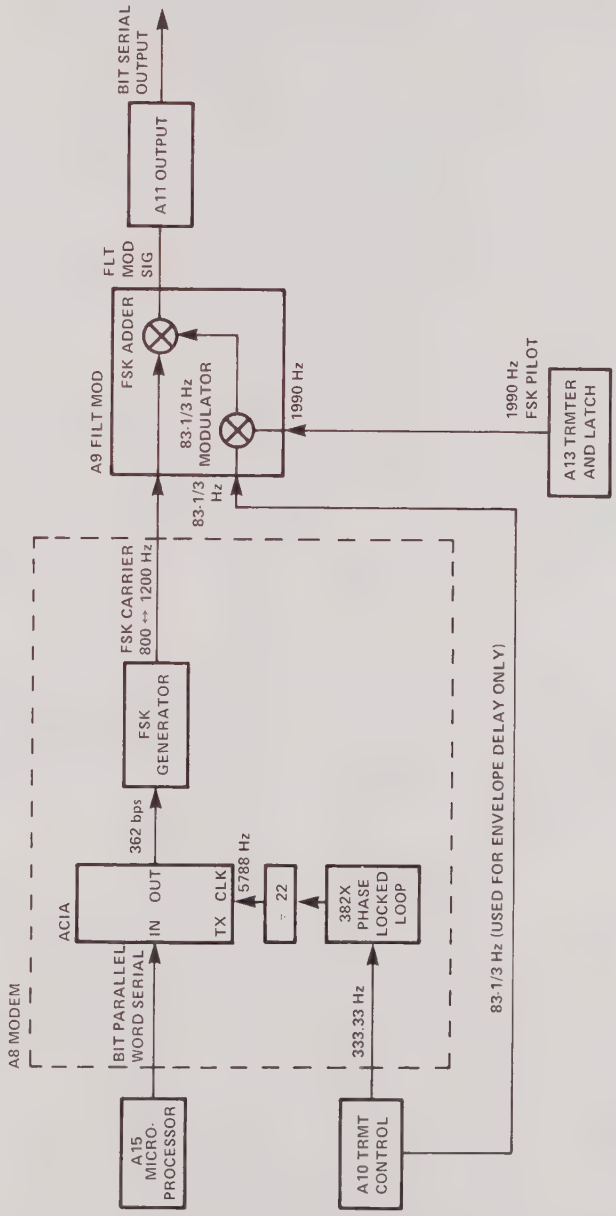


Figure 8-11. Modem Transmit Block Diagram

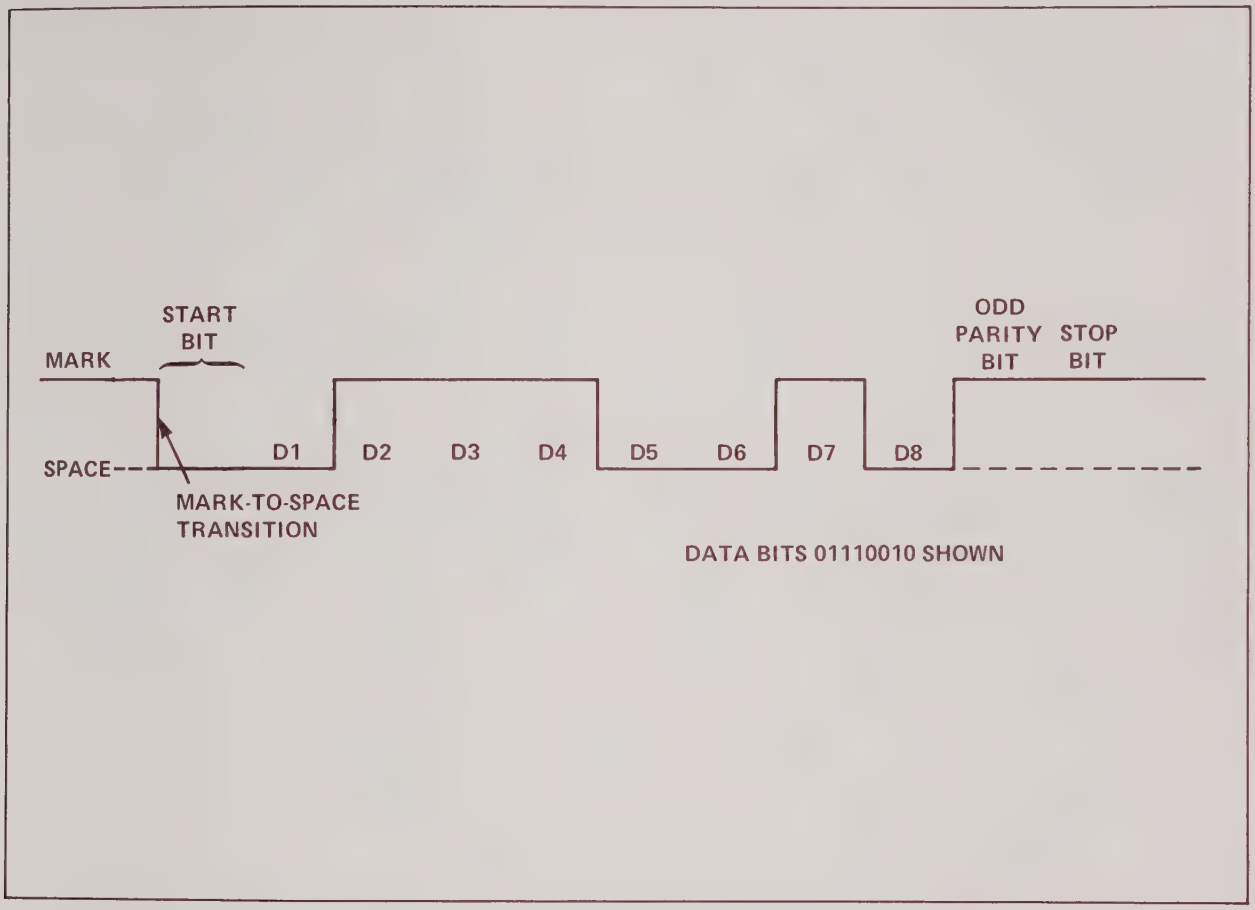


Figure 8-12. Modem Data Word

8-81. MODEM OPERATION, TRANSMIT

8-82. The modem circuitry enables communication between the widely separated master and slave units. This allows the master-slave function to operate. Communication takes place over a 4-wire telephone circuit. Figure 8-11 illustrates the modem transmit function.

8-83. The data to be transmitted is originated by the microprocessor assembly. The microprocessor transfers information to the modem over the 8-bit data bus in a bit parallel, word serial fashion. The ACIA device (asynchronous communications interface adapter) accepts the 8-bit parallel word. The ACIA outputs the 8-bits in serial fashion (one bit at a time) to the FSK generator. The FSK generator converts the input dc voltage levels to the shifting 800 Hz — 1200 Hz FSK carrier.

8-84. The ACIA formats the 8-bit word into an eleven bit serial word as shown in Figure 8-12. A mark-to-space transition "start bit" precedes the data word. An odd parity bit plus a mark stop bit are added at the end. These data bits are transmitted at a 362 baud rate (362 bps). To achieve this rate, the 5788 Hz transmit clock is divided by 16 inside the ACIA.

8-85. The FSK carrier is combined with a 1990 Hz signal (FSK pilot) during modem operation. The two signals are mixed at the filter modulator assembly before passing to the output board. The presence of the 1990 Hz pilot "alerts" the far end modem receive circuits that an FSK signal is being received.

8-86. While testing for envelope delay in the slave-to-master direction, the 1990 Hz signal also serves as the fixed frequency envelope delay carrier. This is a special case for the envelope delay measurement.

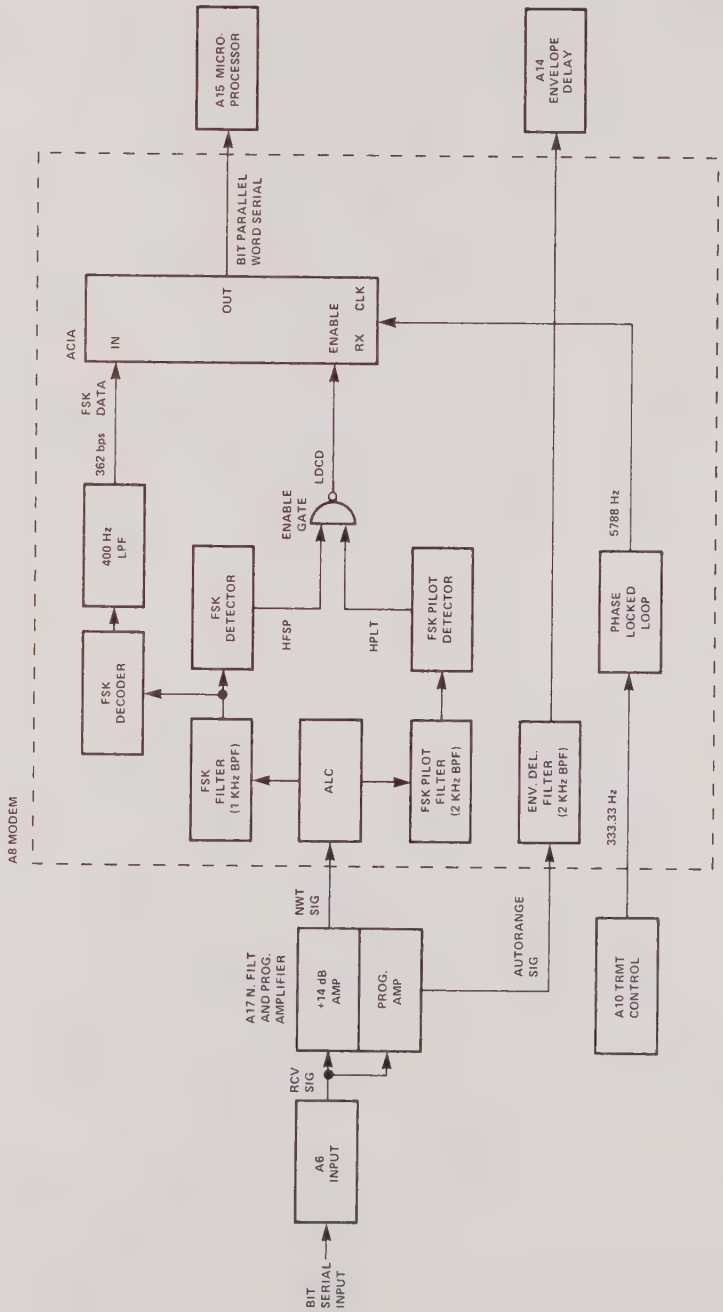


Figure 8-13. Modem Receive Block Diagram

8-87. MODEM OPERATION, RECEIVE

8-88. Figure 8-13 illustrates modem receive operation. The received signal arrives at the modem after receiving a fixed amplification at the A17 assembly. The modem automatic level control (ALC) circuit normalizes the received signal level. This normalized signal is passed to the FSK filter and the FSK pilot filter.

8-89. The FSK filter passes only the FSK signal (800 Hz and 1200 Hz) to the FSK detector. With an apparent FSK signal present, the enable gate has one input true. The FSK pilot filter passes only the 1990 Hz signal to the FSK pilot detector. With a 1990 Hz signal present, it is confirmed that FSK from the far end unit has arrived. The remaining input of the enable gate then goes true. The gate then produces the data carrier detect signal (LDCD) to "tell" the ACIA to begin accepting the incoming data.

8-90. The output of the FSK filter is also routed to the FSK decoder. This circuit converts the shifting FSK carrier to a string of data pulses. The 400 Hz low pass filter allows only the 362 baud signal to pass. The ACIA converts the incoming serial bits into 8-bit parallel words for the microprocessor.

8-91. During the special case of testing for envelope delay in the slave-to-master direction, the 1990 Hz signal is also routed to the envelope delay filter. This filter serves to pass the 1990 Hz signal with its AM modulation. The output of this filter is used for the actual envelope delay measurement. This extra filtering is needed to help separate out the 1990 Hz signal from the FSK signal. At the envelope delay board, the 83-1/3 Hz modulation is removed for transmission back to the master unit.

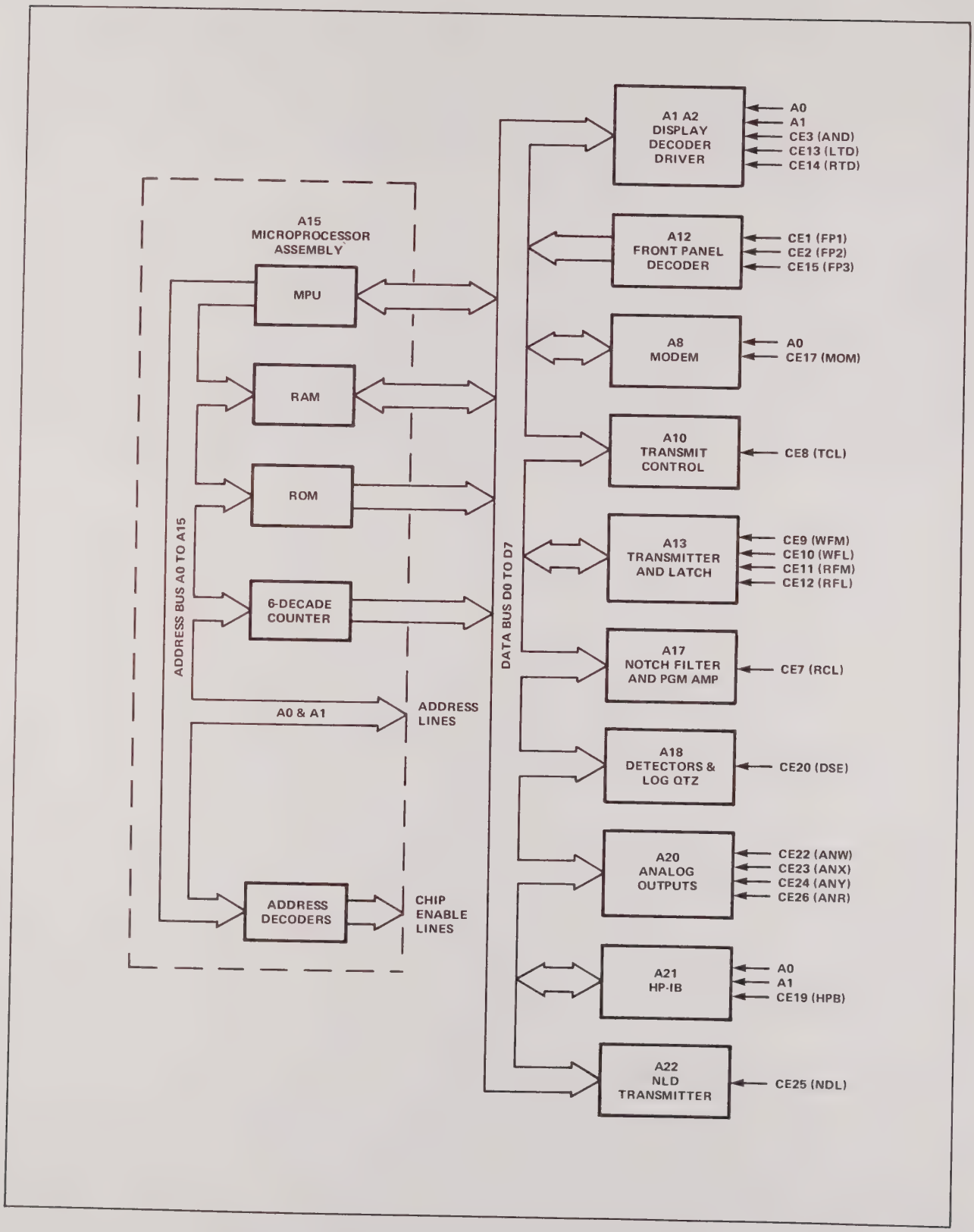


Figure 8-14. Microprocessor Control

8-92. MICROPROCESSOR CONTROL

8-93. The control center of the Model 4943A is the microprocessor assembly. This is where the magic takes place. See Figure 8-14.

8-94. Communication takes place between the microprocessor assembly and the other assemblies over the data bus. This data bus is actually 8 wires in parallel, between the affected circuitry. The bus is shared by its users in the time domain. Only one "talker" is active at any one time, the other talkers are silent. More than one "listener" may be active at any one time.

8-95. Some assemblies only talk (output data onto the bus), such as the A12 front panel decoder. Others only listen (receive data from the bus), as the A1A2 display decoder driver. Many boards can do both, such as the A21 HP-IB assembly.

8-96. The MPU (microprocessor unit) chip at A15 commands control of the data bus. This device selects the appropriate talker and listener using the address bus. The address lines and chip enable lines are selectively activated to "latch-in" data into the listeners; and to allow output of data (using tri-state buffers) onto the bus.

8-97. The same data bus and address bus allows communication within the microprocessor assembly. The processor (MPU) is the decision maker or controller of the system. The RAM (random access memory) is the "scratchpad" (or temporary) memory for the processor. The ROM (read only memory) contains the permanent memory for the processor, and contains all firmware. The 6-decade counter is used for such things as counting transmit signal frequency, and is shared by many measurements.

8-98. MNEMONIC DICTIONARY

8-99. Table 8-1 gives a list of all digital control mnemonics used in the Model 4943A. These mnemonics are abbreviations of more complete signal names. For instance, "QTM" represents "Quiet Termination".

8-100. The active state or prefix of the mnemonics is not given in Table 8-1 (ex.: HQTM). An "H" prefix represents an active HIGH state signal; an "L" would be low active. These state prefixes are not given because they change from circuit to circuit. This happens, for instance, when the functional signal is transformed by an inverting buffer. The HQTM signal line is expected to be at a HIGH state during C-message noise measurement.

8-101. A few of the signal lines have a dual mnemonic. The chip enable lines are an example. Figure 8-14 shows some of these. The chip enable lines are essentially "latch enable" signals. The corresponding descriptive mnemonic imparts a functional purpose. For example,"CE19" is also known as "HPB" for Hewlett-Packard Interface Bus Enable".

8-102. LOCATOR DRAWINGS

8-103. Figure 8-15 shows the location of all replaceable assemblies. All plug-in PC boards and plug-in cables are shown for easy identification. Figure 8-16 identifies the components mounted on the front panel, and Figure 8-17 shows the rear panel.

8-104. SCHEMATIC NOTES

8-105. Table 8-2 provides general schematic notes for interpretation of the schematic diagrams. A review of this table will definitely help to understand the schematics in this manual.

Table 8-1. Model 4943A Mnemonic Dictionary (1 of 7)

MNEMONIC	FUNCTION	
AB1 thru AB7	Annunciator Bits	
ACD	Accept Data	
ACH	Acceptor Handshake	
ACK	Analog Clock	
AEB	A Equals B (Address Matches X)	
AGC	Automatic Gain Control	
ALC	Automatic Level Control	
ALT	Segment A, Left Display	
AND	Annunciator Data Strobe	
ANP	Analog Present	
ANR	Analog Read	(CE26)
ANW	Analog Write	(CE22)
ANX	Analog X-Axis	(CE23)
ANY	Analog Y-Axis	(CE24)
AN1 thru AN4	Display Anodes	
ART	Segment A, Right Display	
ASR	Access Software Routine (Signature Analysis)	
ATN	Attention	
AVD	Average Detector	
A=B	A Equals B (HP-IB Address Present)	
BAC	Byte Accepted	
BAV	Bus Available	
BKL	Break Loop	
BLT	Segment B, Left Display	
BPF	Band Pass Filter	
BRG	Bridged	
BRT	Segment B, Right Display	
CE1	Chip Enable 1	(See FP1)
CE2	Chip Enable 2	(See FP2)
CE3	Chip Enable 3	
CE4	Chip Enable 4	
CE5	Chip Enable 5	
CE6	Chip Enable 6	
CE7	Chip Enable 7	(See RCL)
CE8	Chip Enable 8	(See TCL)
CE9	Chip Enable 9	(See WFM)
CE10	Chip Enable 10	(See WFL)
CE11	Chip Enable 11	(See RFM)
CE12	Chip Enable 12	(See RFL)
CE13	Chip Enable 13	

Table 8-1. Model 4943A Mnemonic Dictionary (2 of 7)

MNEMONIC	FUNCTION	
CE14	Chip Enable 14	
CE15	Chip Enable 15	(See FP3)
CE16	Chip Enable 16	
CE17	Chip Enable 17	(See MOM)
CE18	Chip Enable 18	
CE19	Chip Enable 19	(See HPB)
CE20	Chip Enable 20	(See DSE)
CE21	Chip Enable 21	
CE22	Chip Enable 22	(See ANW)
CE23	Chip Enable 23	(See ANX)
CE24	Chip Enable 24	(See ANY)
CE25	Chip Enable 25	(See NDL)
CE26	Chip Enable 26	(See ANR)
CE27	Chip Enable 27	
CE28	Chip Enable 28	
CE29	Chip Enable 29	
CE30	Chip Enable 30	
CE31	Chip Enable 31	
CE32	Chip Enable 32	
CE33	Chip Enable 33	
CE34	Chip Enable 34	
CE35	Chip Enable 35	
CHK	NLD Check	
CKS	Check Signal	
CLR	Clear	
CLT	Segment C, Left Display	
CMF	C-Message Filter	
CMS	C-Message Noise	
CRM	Clear RAM Memory	
CRT	Segment C, Right Display	
CTR	Counter Enable	
CTS	Counts	
DAC	Data Accepted	
DAV	Data Valid	
DBA	Data Byte Accepted	
DBM	DBM	
DBC	DBRNC	
DBV	Data Byte Valid	
DBX	DB	
DCD	Data Carrier Detect	

Table 8-1. Model 4943A Mnemonic Dictionary (3 of 7)

MNEMONIC	FUNCTION
DCL	Device Clear
DI01 thru DI08	Data Input/Output Lines on HP-IB Bus
DLT	Segment D, Left Display
DPL	Decimal Point, Left Display
DRT	Segment D, Right Display
DRV	Drive
DSE	Detector Select Latch Enable (CE20)
DSL	Display Level
DZO	Delay Zero
D/T	Dial/Talk
D0 thru D7	Data Bus Bits
EDD	Envelope Delay Distortion
ELT	Segment E, Left Display
ENW	Enable Weighting Filters
EOD	End of Data
EOI	End or Identify
EOR	End of Range (TRMT Frequency)
EOS	End of Sweep
ERT	Segment E, Right Display
FLA	Flat Input (no notch)
FLT	Segment F, Left Display
FPD	Front Panel Disable
FP1	Front Panel Enable #1 (CE1)
FP2	Front Panel Eanble #2 (CE2)
FP3	Front Panel Enable #3 (CE15)
FP4	Front Panel Enable #4
FRT	Segment F, Right Display
FSC	Full Scale
FSK	Frequency Shift Keying
FSP	FSK Present
FST	FSK Transmit
FWA	Full Wave Average
FXF	Fixed Frequency
GET	Group Execute Trigger
GLT	Segment G, Left Display
GRT	Segment G, Right Display
GTL	Go to Local
HLD	Hold
HLT	Halt
HPB	HP-IB Enable (CE19)

Table 8-1. Model 4943A Mnemonic Dictionary (4 of 7)

MNEMONIC	FUNCTION	
HPF	High Pass Filter	
IDR	Input Signal Dropout	
IFC	Interface Clear	
ILO	Impulse Noise Loop	
IMN	Impulse Noise	
IND	Impulse Noise Data	
INL	Impulse Noise Latch	
INP	In Process	
IRQ	Interrupt Request	
I1M	Inhibit 1 MHZ	
JSC	Phase Jitter Self-Check	
LAD	Listener Addressed	
LAR	Loop Around	
LFØ	Low Frequency Phase Jitter	
LIS	Listener Block Address	
LLB	Line Loop Back	
LLS	Load Least Significant Bits	
LMS	Load Most Significant Bits	
LOL	Lower Limit	
LPF	Low Pass Filter	
LTD	Left Display Data Strobe	
LZO	Level Zero	
L/F	Lever & Frequency	
MAN	Manual Frequency	
MBR	Minus Bar	
MCN	Message Circuit Noise	
MLA	My Listen Address	
MOD	Modem Present	
MOM	Modem Enable	(CE17)
MRS	Master Reset	
MSC	Microseconds	
MTA	My Talk Address	
MTF	Monitor Transmit Frequency	
MTL	Monitor Transmit Level	
MTS	Master-to-Slave	
M83	83-1/3 Hz from Modem	
NCH	Notch Filter (SSC)	
NDL	Nonlinear Distortion Latch	(CE25)
ND1	860 Hz Present	
ND2	1380 Hz Present	

Table 8-1. Model 4943A Mnemonic Dictionary (5 of 7)

MNEMONIC	FUNCTION	
NDR	Nonlinear Distortion Receive	
NLD	Nonlinear Distortion Detector	
NMD	Normal (Delay Switch)	
NMI	Non-maskable Interrupt	
NMR	Normal (Remote Switch)	
NSP	Non-Stop	
NWT	Noise-with-Tone	
OF1	Option Flag No. 1	
OF2	Option Flag No. 2	
OOR	Out of Range	
OTA	Other Talk Address	
OVF	Overflow	
OVR	Override	
PBR	Plus Bar	
PCD	Phase Correction Disable	
PDN	Pen Down	
PEN	Polarity Enable	
PLD	Parallel Load Frequency Counters	
PLP	Phase Lock Present	
PLT	FSK Pilot Present	
PRM	Enable PROM	
PSE	Polarity Select	
P30	Plus 30 dB Gain	
QRM	Quasi RMS Detector	
QTM	Quiet Termination	
QTZ	Quantize	
RAM	Enable RAM	
RCL	Receive Latch	(CE7)
RCV	Receive	
REM	Remote	
REN	Remote Enable	
RES	Reset/Start	
REV	Reverse	
RFD	Ready for Data	
RFL	Read Frequency Least Significant Bits	(CE12)
RFM	Read Frequency Most Significant Bits	(CE11)
RHS	Reset Horizontal Sweep	
RHZ	Receive HZ	
RIM	Read Into Microprocessor	
RSC	Receive Select Center Significant Bit	

Table 8-1. Model 4943A Mnemonic Dictionary (6 of 7)

MNEMONIC	FUNCTION
RSG	Receive Signal Select
RSL	Receive Select Least Significant Bit
RSM	Receive Select Most Significant Bit
RSW	Reset Sweep
RTD	Right Display Data Strobe
R83	Receive 83-1/3 Hz to Modulator
RØJ	Read Phase Jitter Status
SAM	Sample
SCK	Self-Check
SDN	Step Down
SFS	Single Frequency Skip
SKP	Skip 2450 to 2750 Hz
SLA	Slave
SLR	Slave (Remote Switch)
SPA	Serial Poll Active
SPD	Serial Poll Disable
SPE	Serial Poll Enable
SPM	Serial Poll Mode
SRQ	Service Request
SSC	Sig Select Center Significant Bit (NCH)
SSL	Sig Select Least Significant Bit
SSM	Sig Select Most Significant Bit
STM	Slave-to-Master
STN	Signal-to-Noise Ratio
STP	Stop
STS	Start the Sweep
SUP	Step Up
SWF	Select Weighting Filters
SWP	Sweep
SYR	System Reset
SYS	System Set
TAC	Talker Active
TAD	Talker Address
TCL	Transmit Control Latch (CE8)
THZ	Transmit Hz
TKB	Talk Battery
TLK	Talk Block Address
TMN	Transmit Level Monitor
TMT	Display Connected to Transmitter
T83	Transmit 83-1/3 Hz to Modulator

Table 8-1. Model 4943A Mnemonic Dictionary (7 of 7)

MNEMONIC	FUNCTION	
UNL	Unlisten	
UPL	Upper Limit	
VMA	Valid Memory Address	
WA1	Write Annunciator No. 1	
WA2	Write Annunciator No. 2	
WFL	Write Frequency, Least Significant Bit	(CE10)
WFM	Write Frequency, Most Significant Bit	(CE9)
WLD	Write Left Display	
WOM	Write Out of Microprocessor	
WRD	Write Right Display	
ZER	Zero/Off	
15M	15 Minutes	
2-3	NLD 2d-3rd	
3KF	3 kHz Low Pass Filter Select	
4KF	4 kHz Low Pass Filter Select	
5MN	5 Minutes	
50H	50 Hz	
600	600 Ohms	
900	900 Ohms	
ØJP	Phase Jitter Period	
ØJT	Phase Jitter	

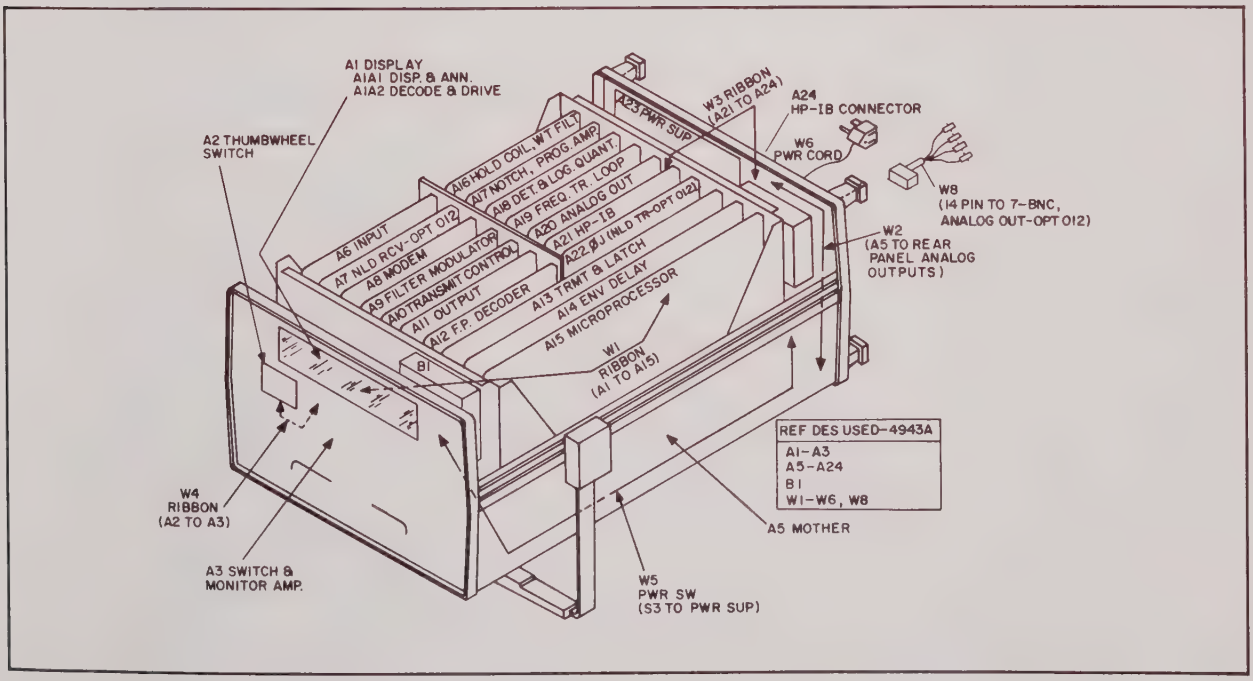


Figure 8-15. Replaceable Assembly Locator

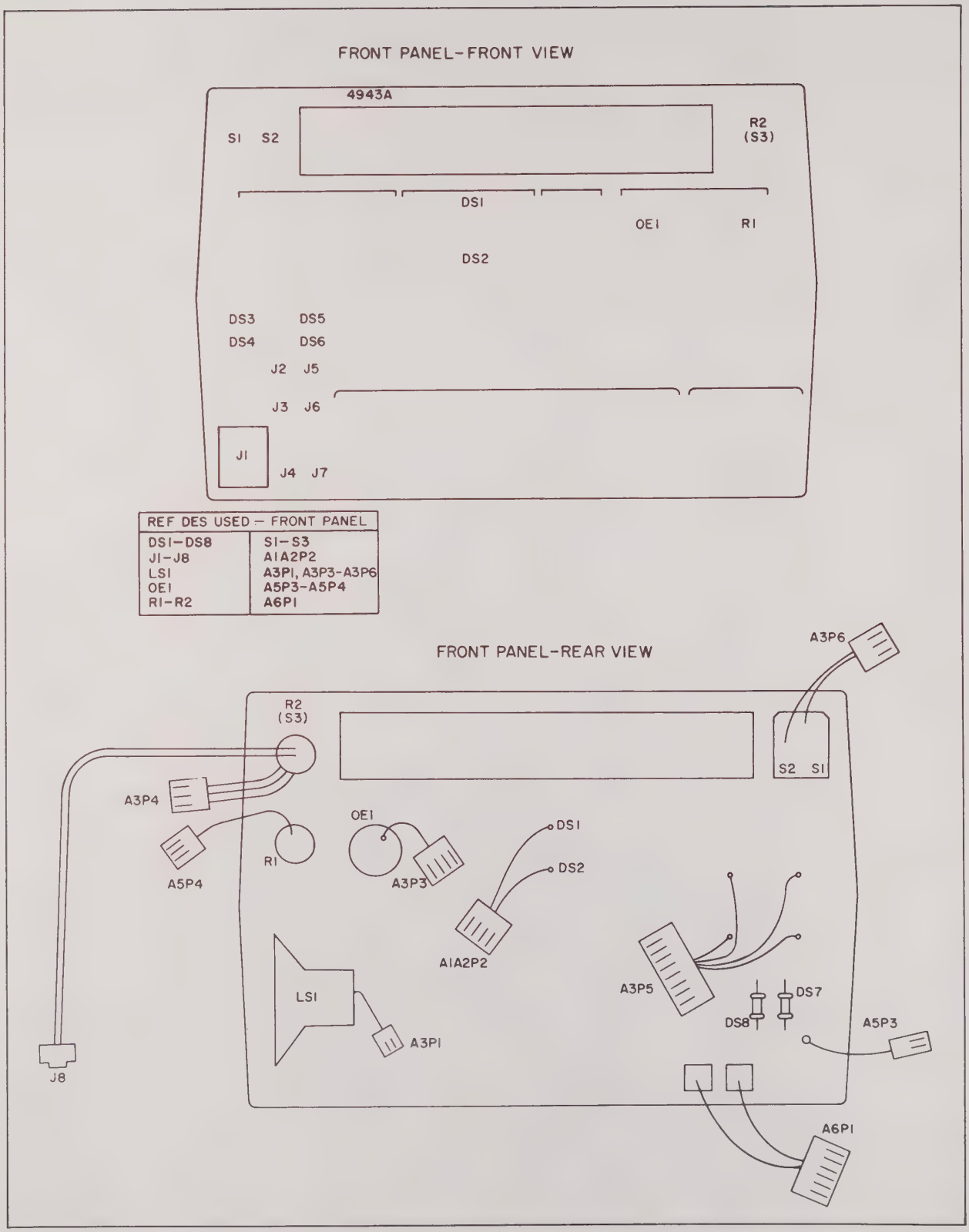


Figure 8-16. Front Panel Area Parts Locator

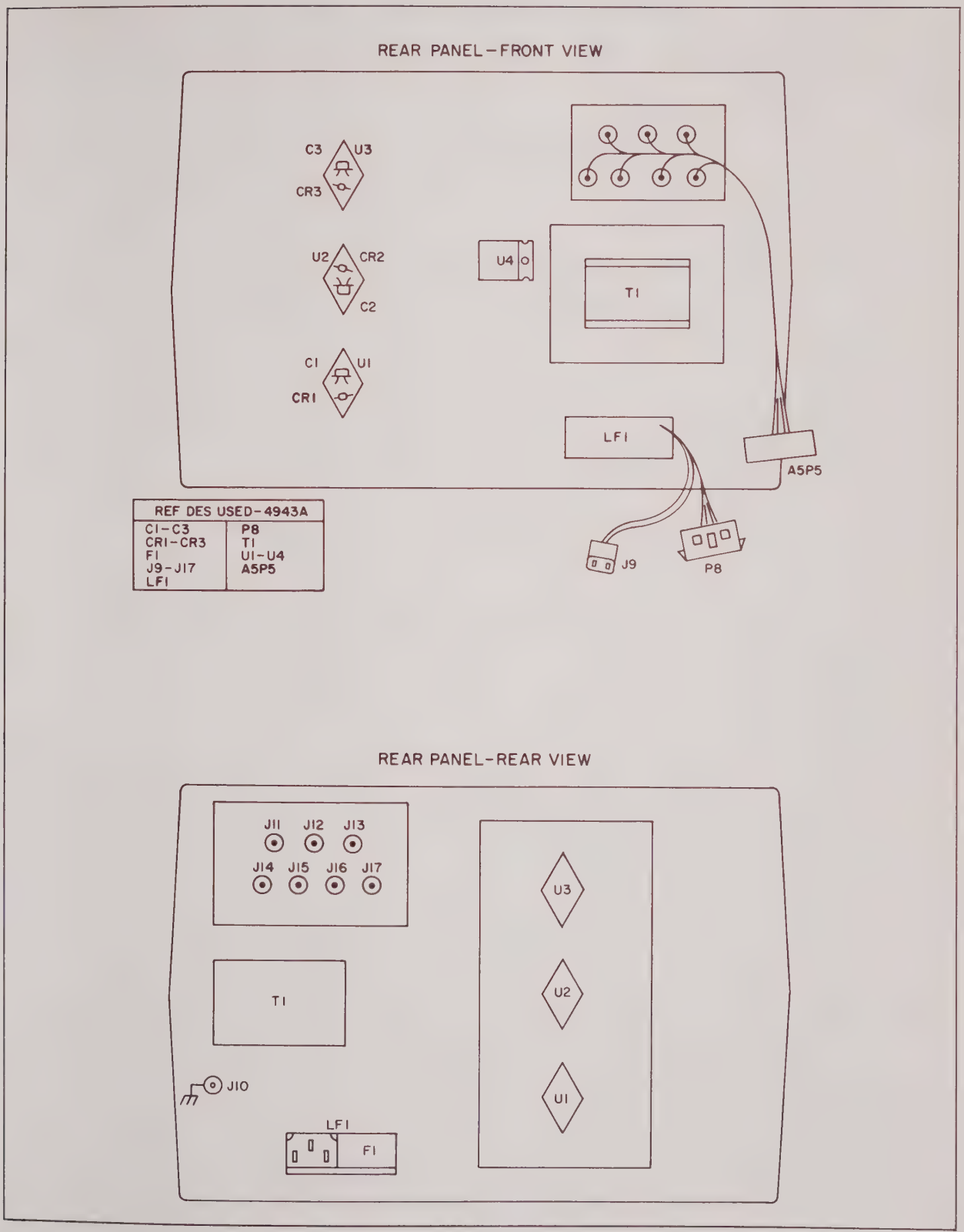


Figure 8-17. Rear Panel Area Parts Locator

Table 8-2. General Schematic Notes (1 of 2)

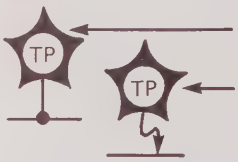
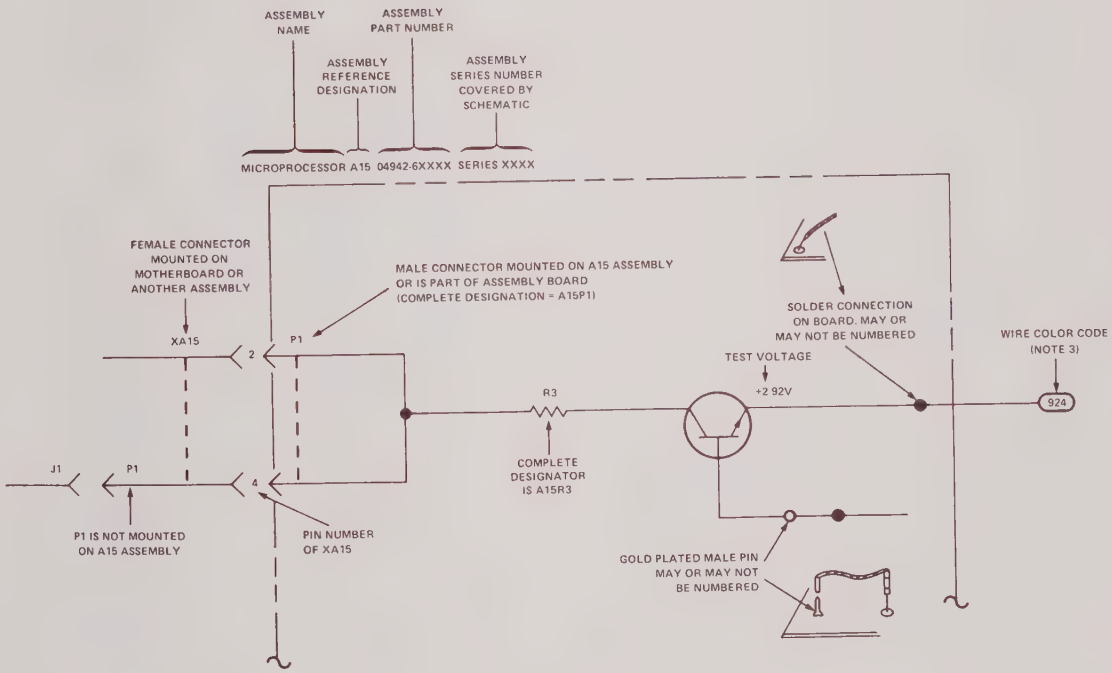
1.		Component values are shown as follows unless otherwise noted: Resistance in ohms. Capacitance in microfarads. Inductance in millihenrys.
2.		P/O = part of.
3.		Denotes wire color: Color code same as resistor color code. First number identifies base color, second number identifies wide strip, third number identifies narrow strip (e.g. 924 denotes white base, red wide strip, yellow narrow strip).
4.		Screwdriver adjustment.
5.		Test point. (Test points shown in this way are gold plated male pins.) Test point. (Test points shown in this way are accessible at the PC board tongue connector using a service extender board.)
6.		PC board assembly outline.
		Circuit stage outline.
		Other assembly outline. Also used to indicate mechanical interconnection (ganging).
7.		Circuit common.
8.		Denotes front panel marking.
9.		Waveforms and ac voltage measurements were made with respect to circuit common using an oscilloscope. The voltage levels shown on the waveforms are actual voltage levels and are not to be confused with oscilloscope setting. The voltage levels shown are nominal and may vary from one instrument to another. A variation of ±10% should be allowed.
10.	+2.92V	DC voltage levels were measured with respect to circuit common using a VTVM with 10 megohm input impedance. The voltage levels shown are nominal and may vary from one instrument to another. A variation of ±10% should be allowed.
11.	A15R3	Reference designations. Partial reference designations are shown. Prefix with assembly designation for complete reference. See following drawing.
12.		Logic Convention: Positive Logic.

Table 8-2. General Schematic Notes (2 of 2)



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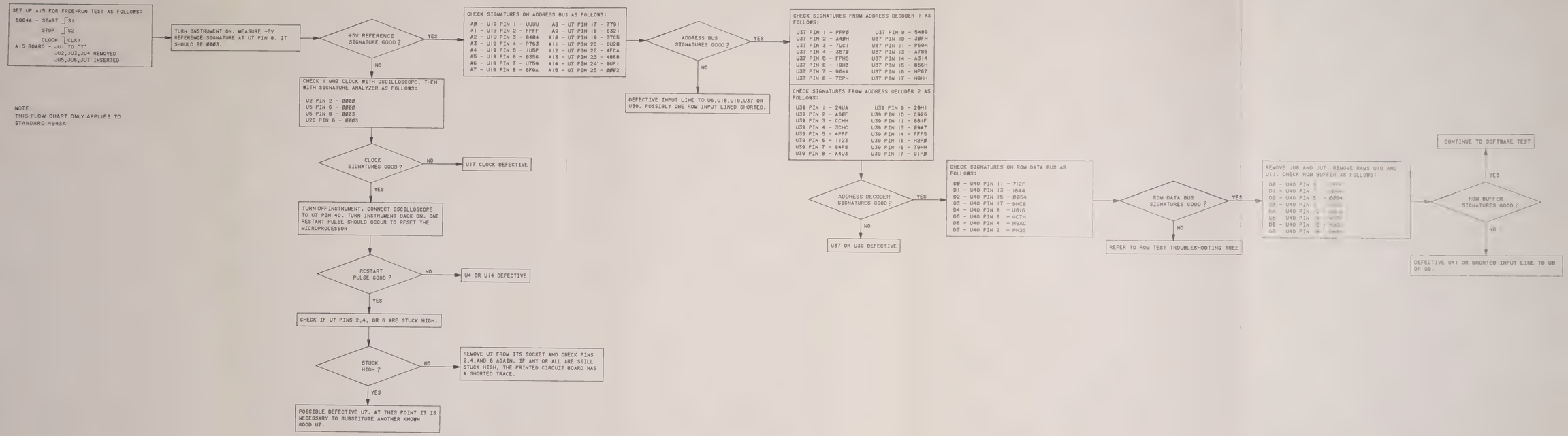

Figure 8-18. Free Run Test, Standard Instrument

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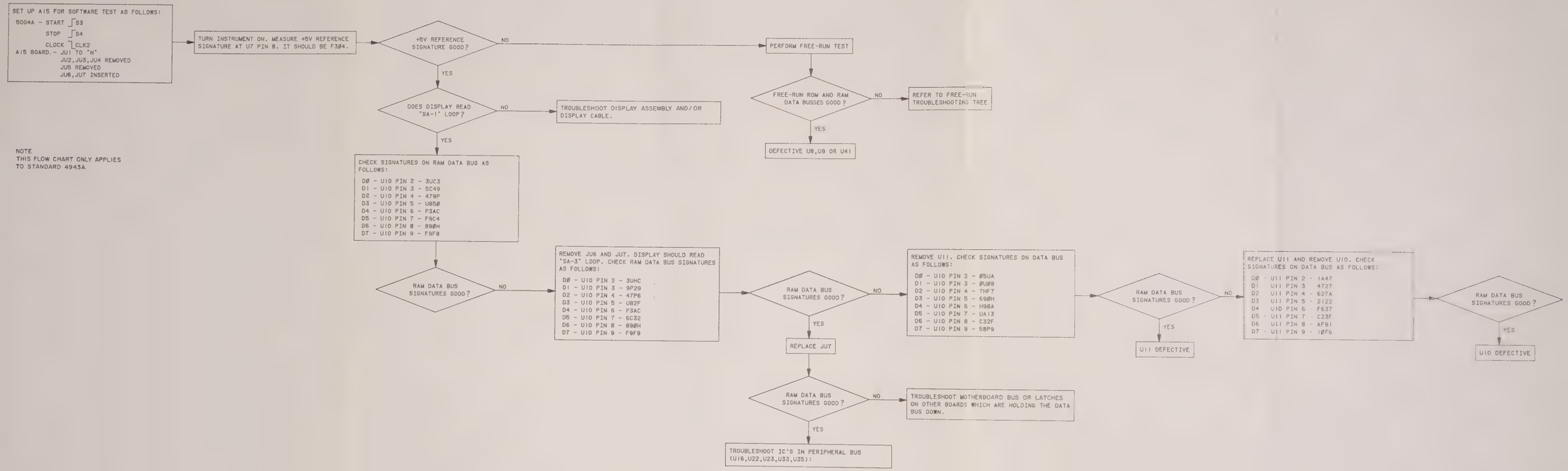

Figure 8-19. Software Test, Standard Instrument

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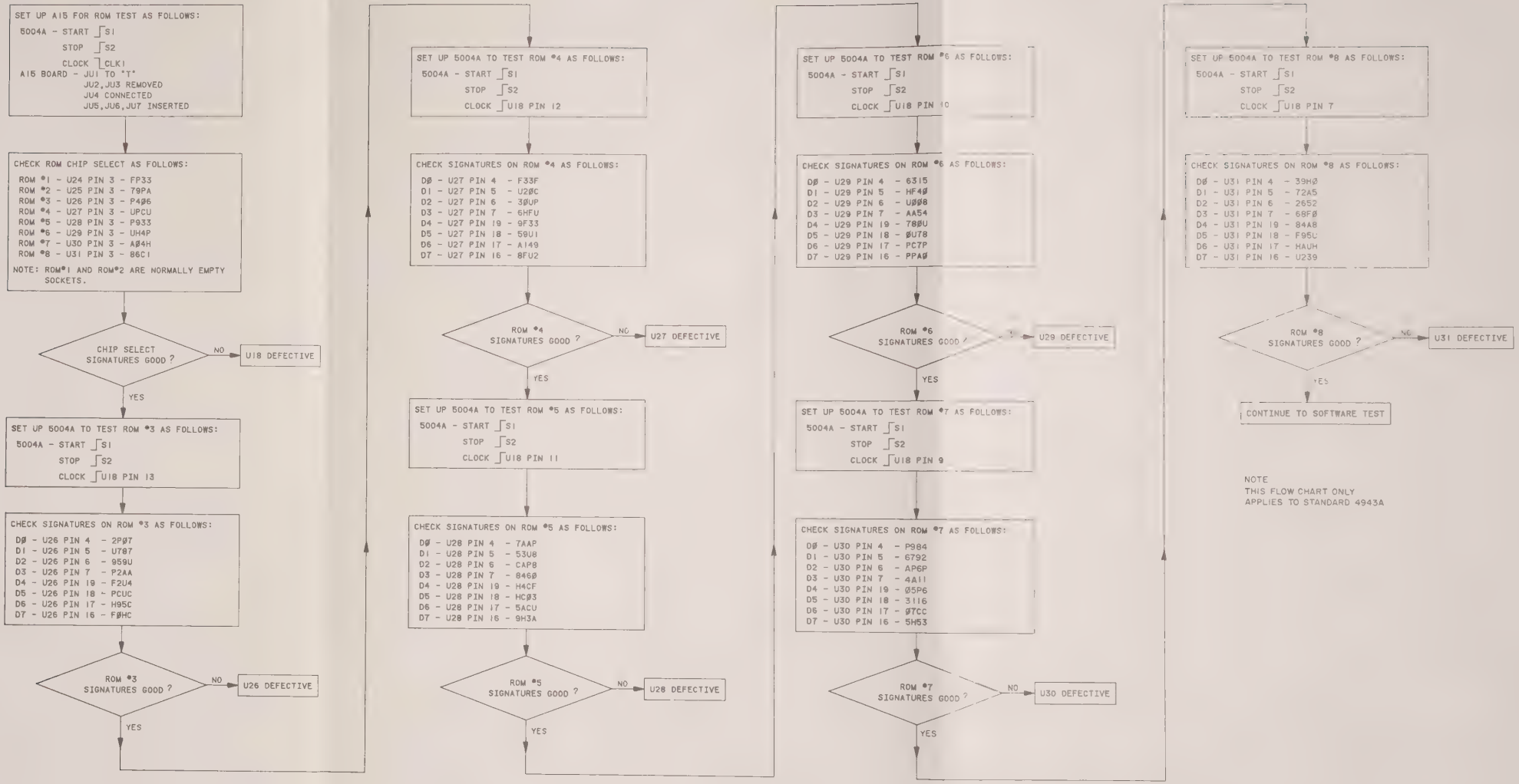

Figure 8-20. ROM Test, Standard Instrument

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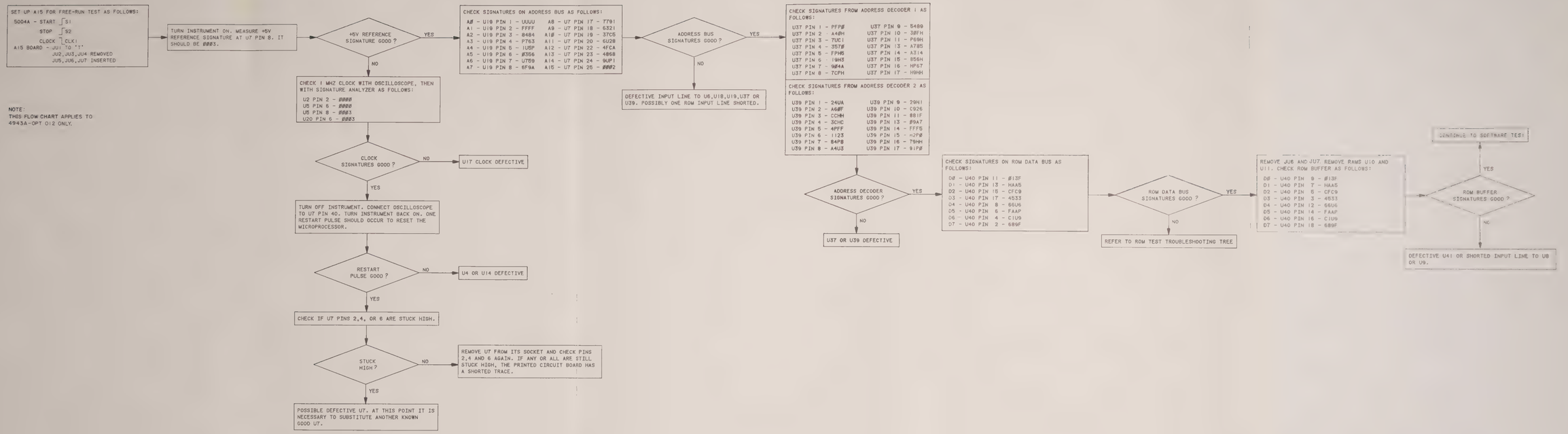

Figure 8-21. Free Run Test, with Option 012 (NLD)

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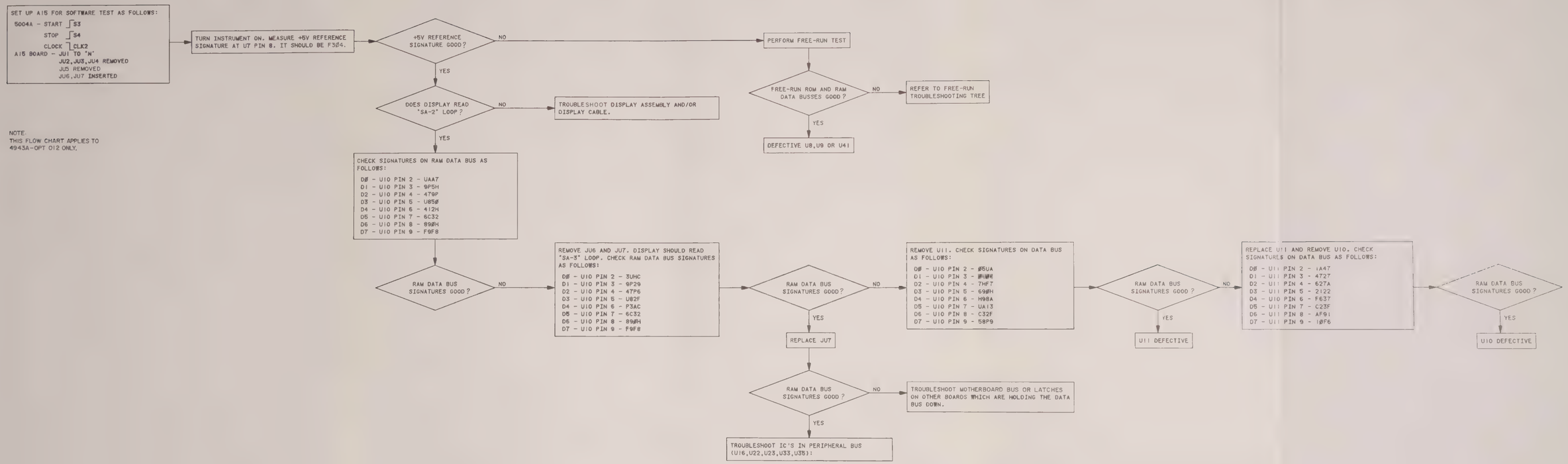

Figure 8-22. Software Test, with Option 012 (NLD)

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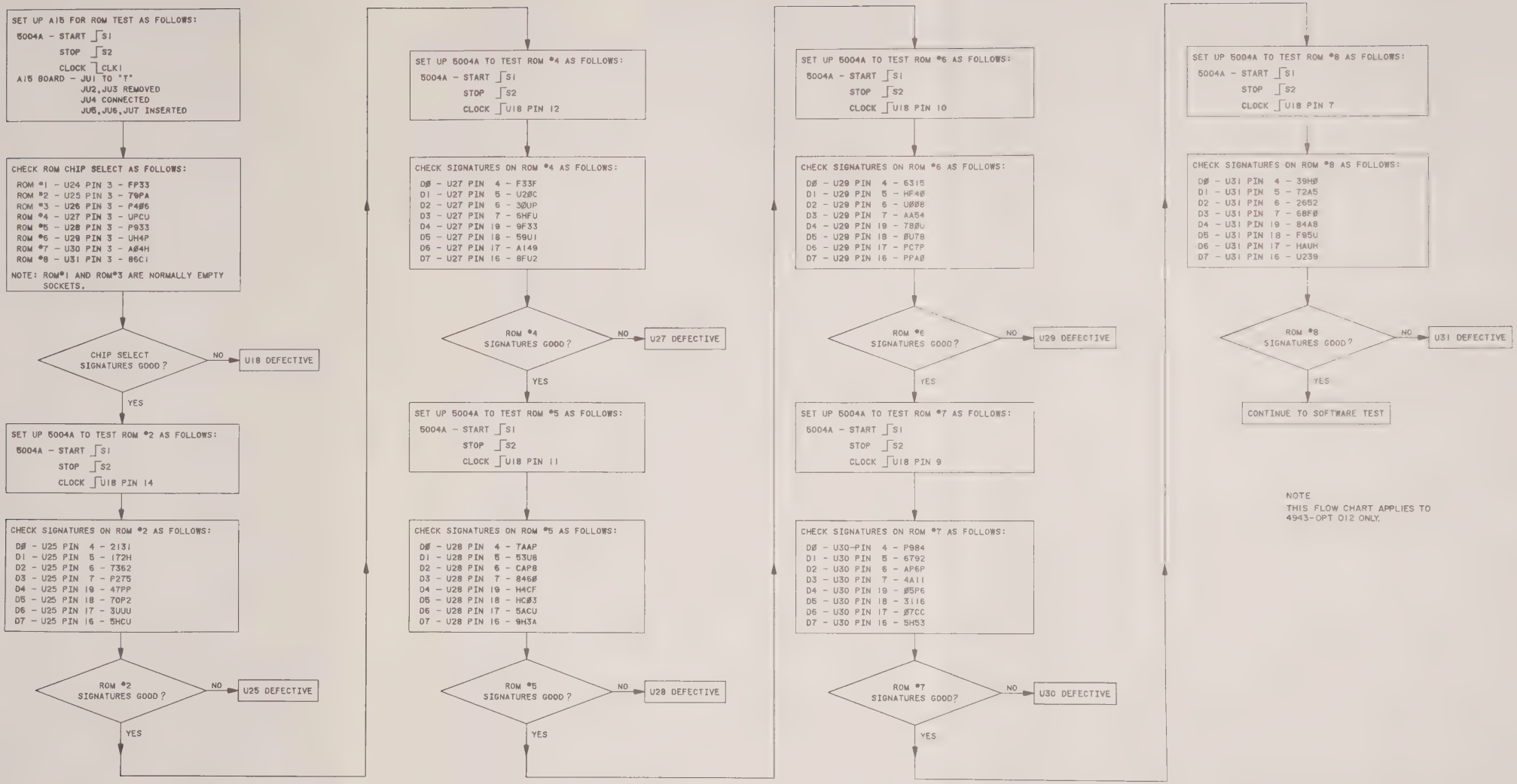

Figure 8-23. ROM Test, with Option 012 (NLD)

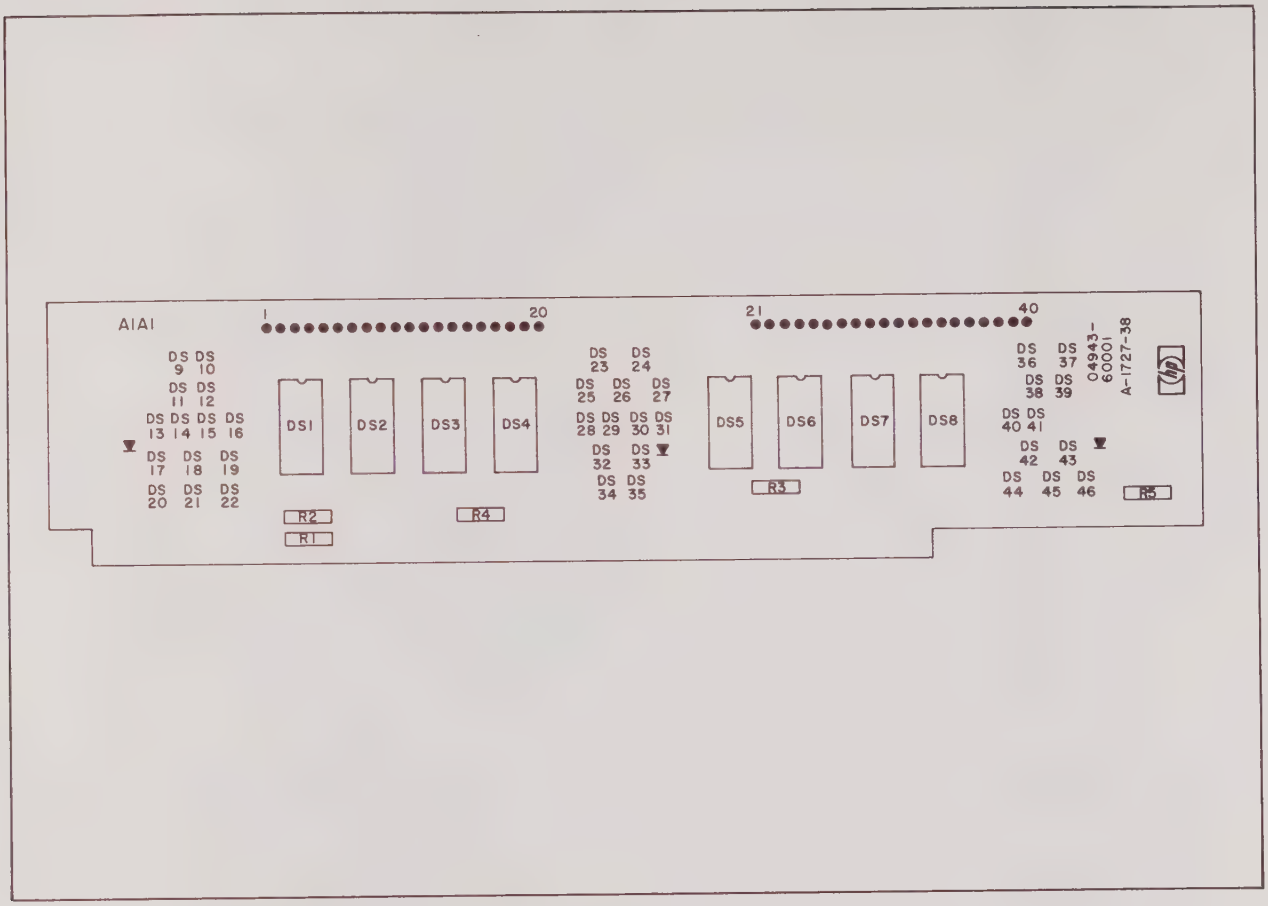

Figure 8-24. A1A1 Display and Annunciator Component Locator

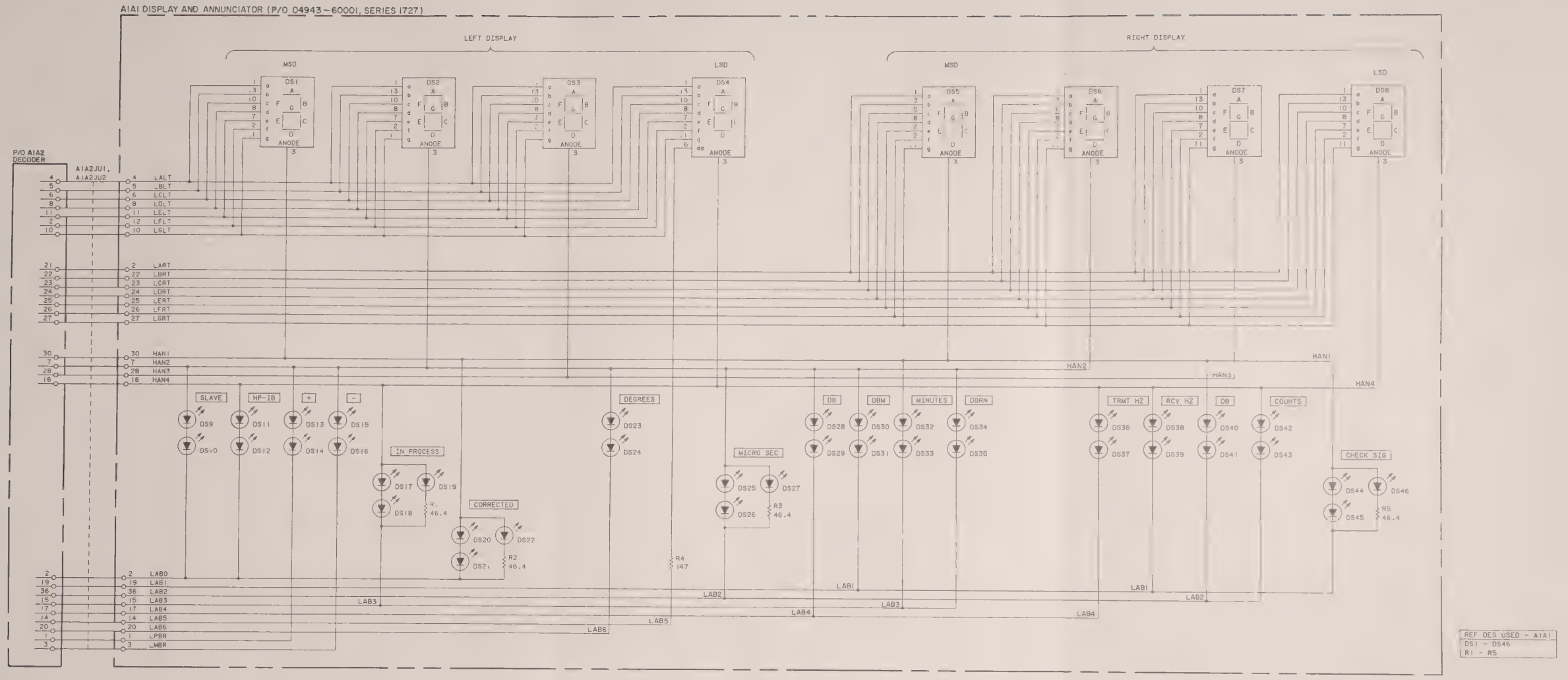

Figure 8-25. A1A1 Display and Annunciator Schematic Diagram

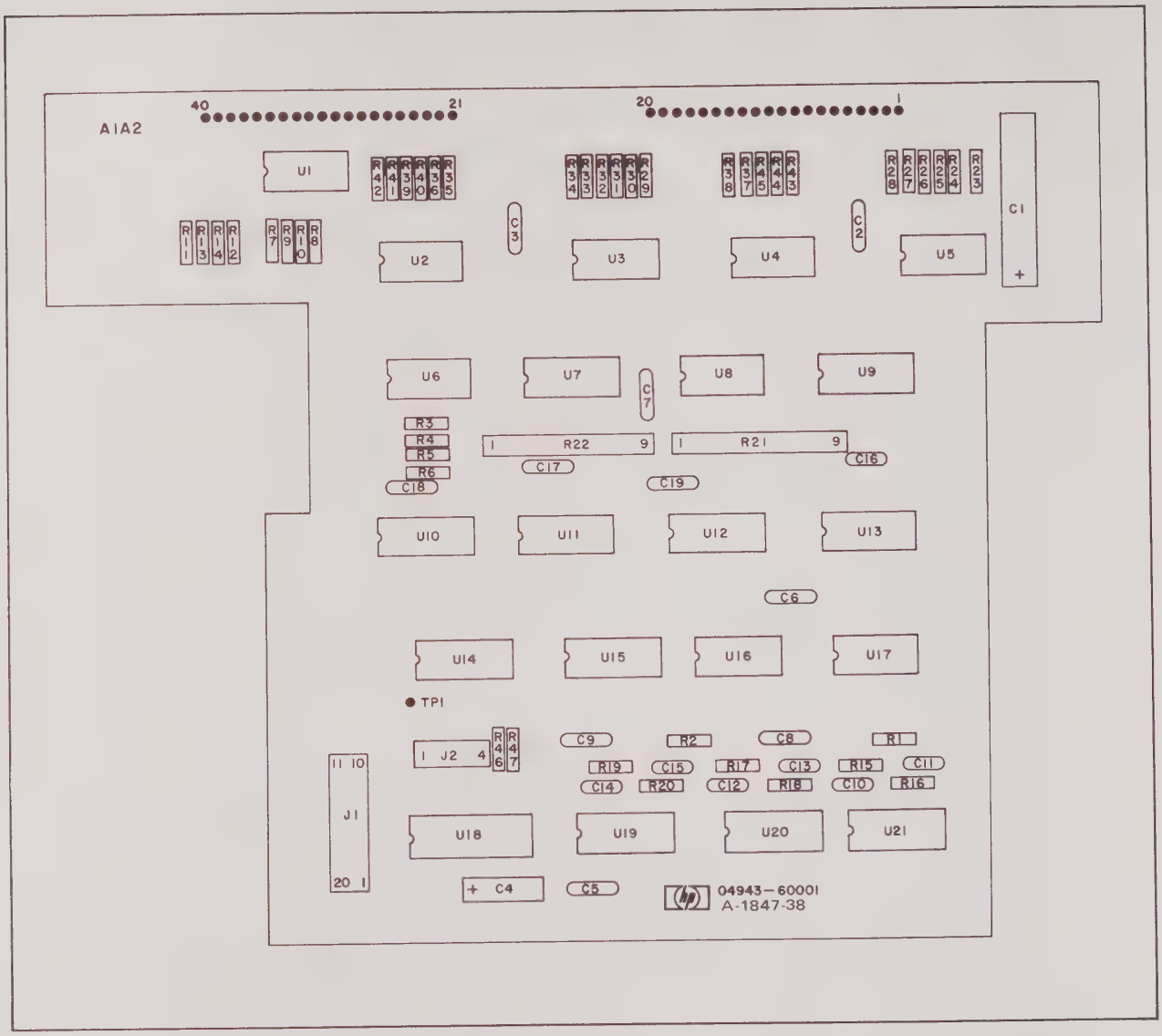

Figure 8-26. A1A2 Display Decoder and Driver Component Locator

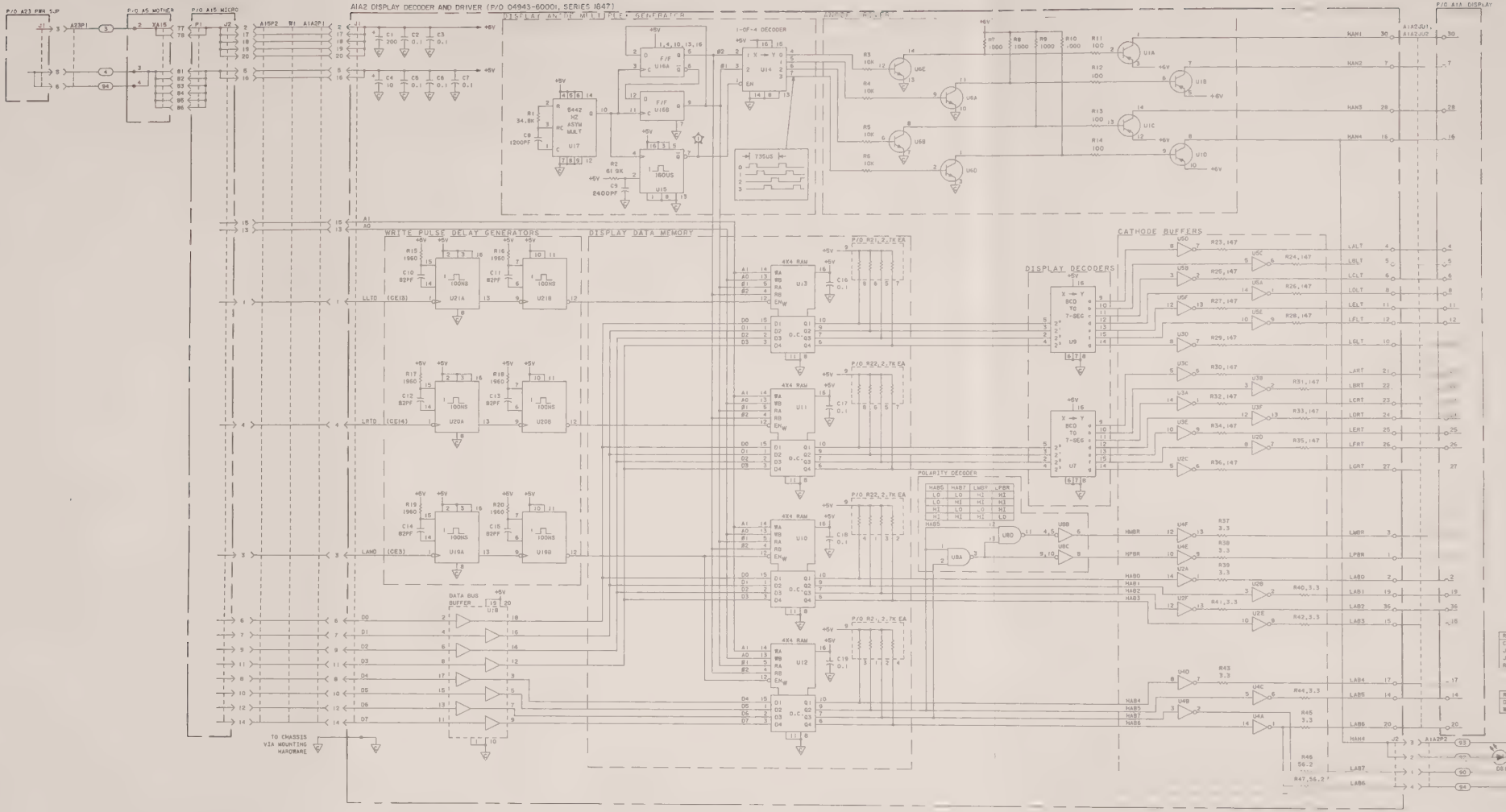

Figure 8-27. A1A2 Display Decoder and Driver Schematic Diagram

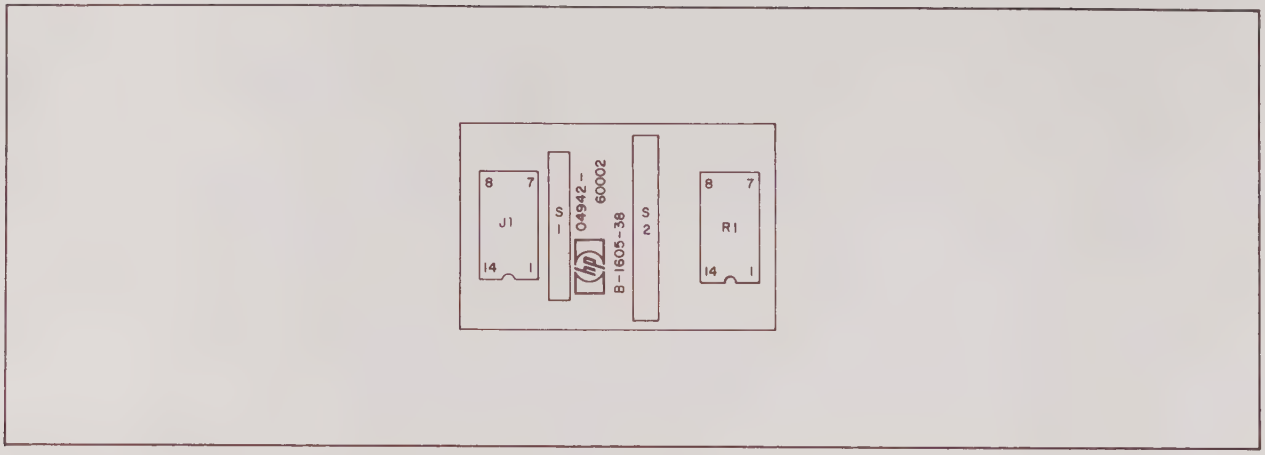

Figure 8-28. A2 Thumbwheel Switch Component Locator

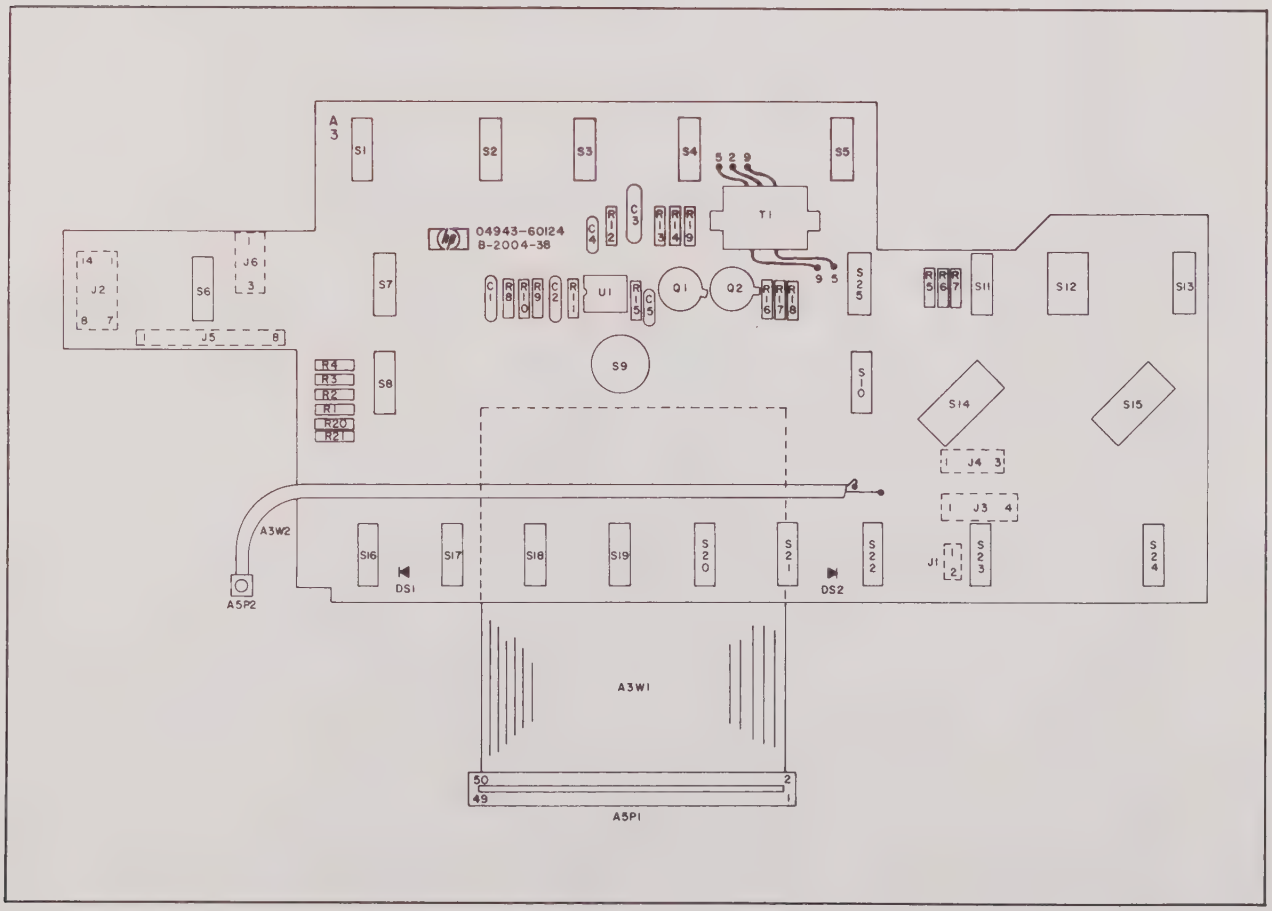

Figure 8-29. A3 Switch Component Locator

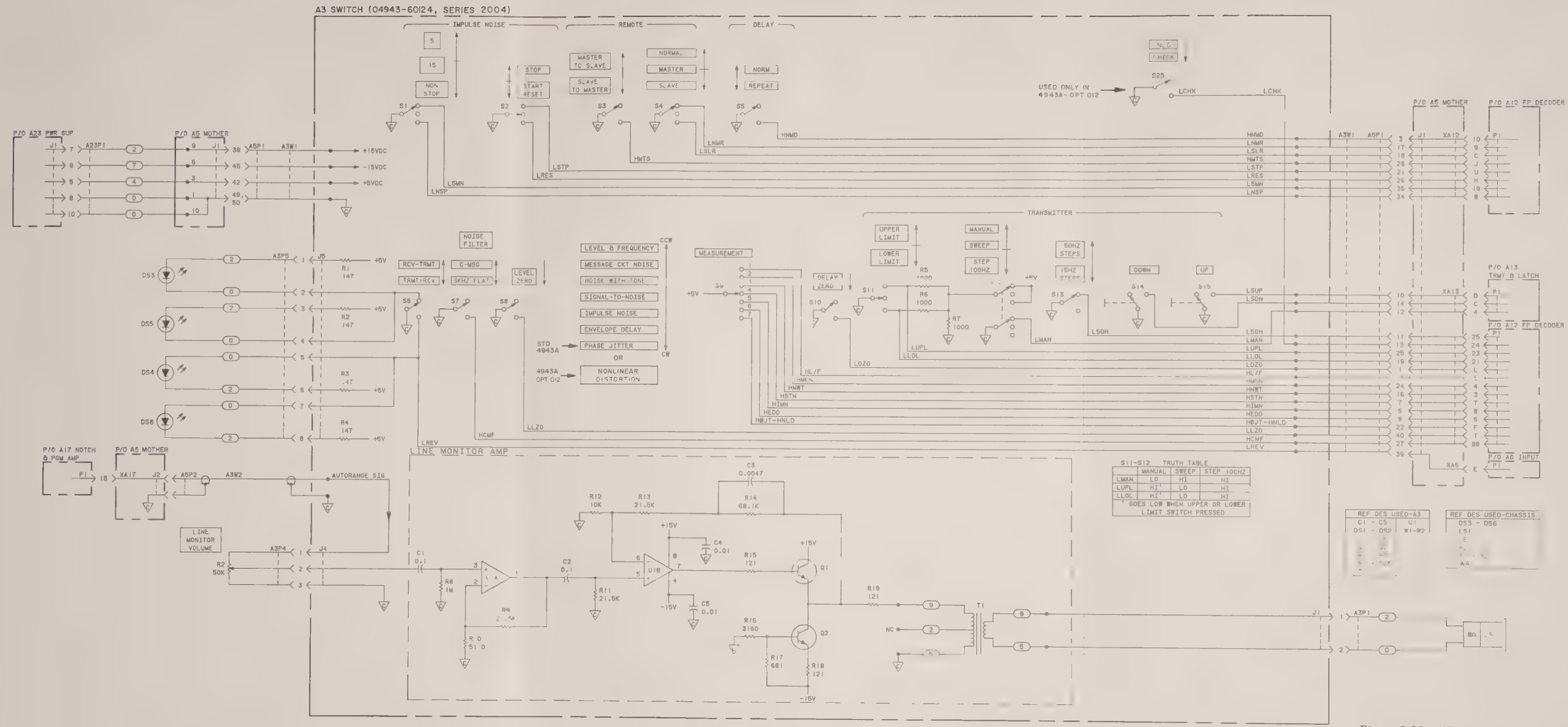

Figure 8-30. A2 Thumbwheel Switch and A3 Switch Schematic Diagram (1 of 2)

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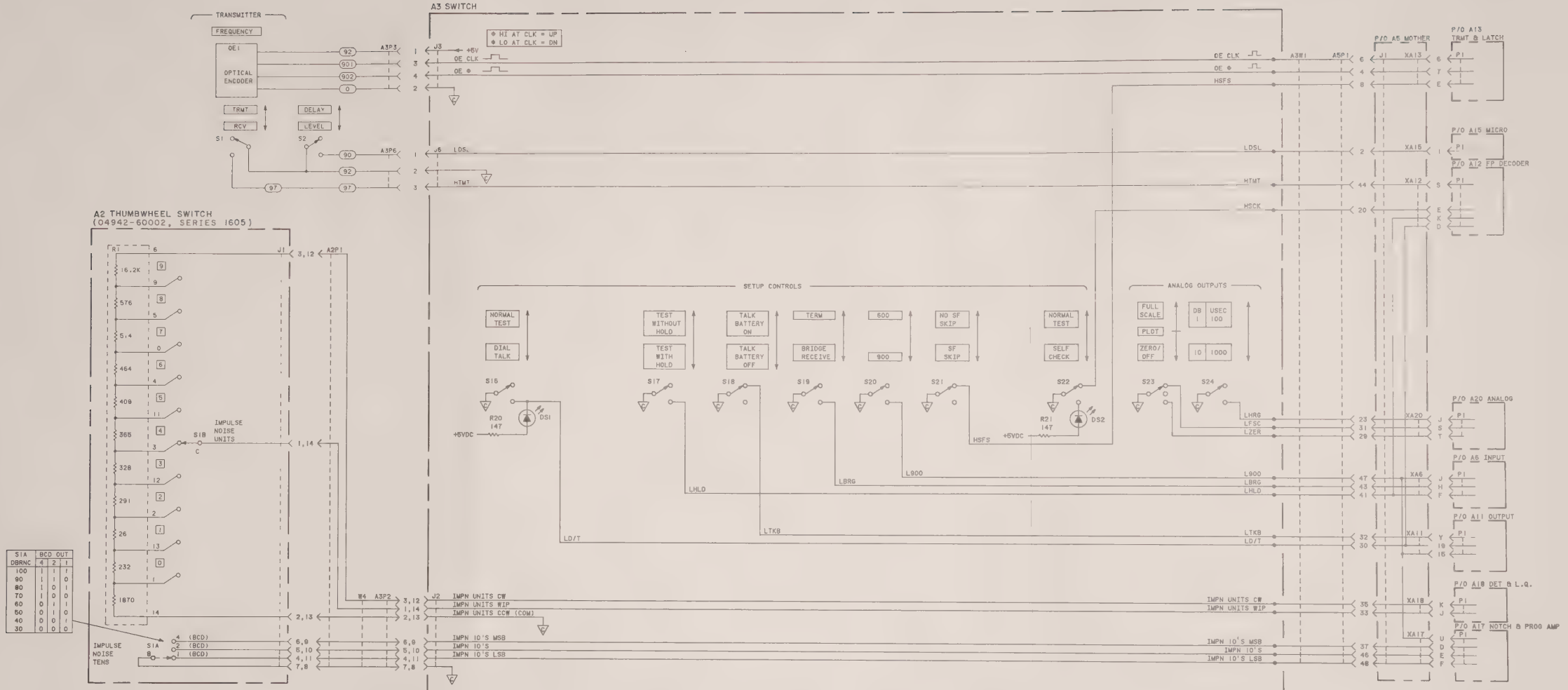

Figure 8-31. A2 Thumbwheel Switch and A3 Switch Schematic Diagram (2 of 2)

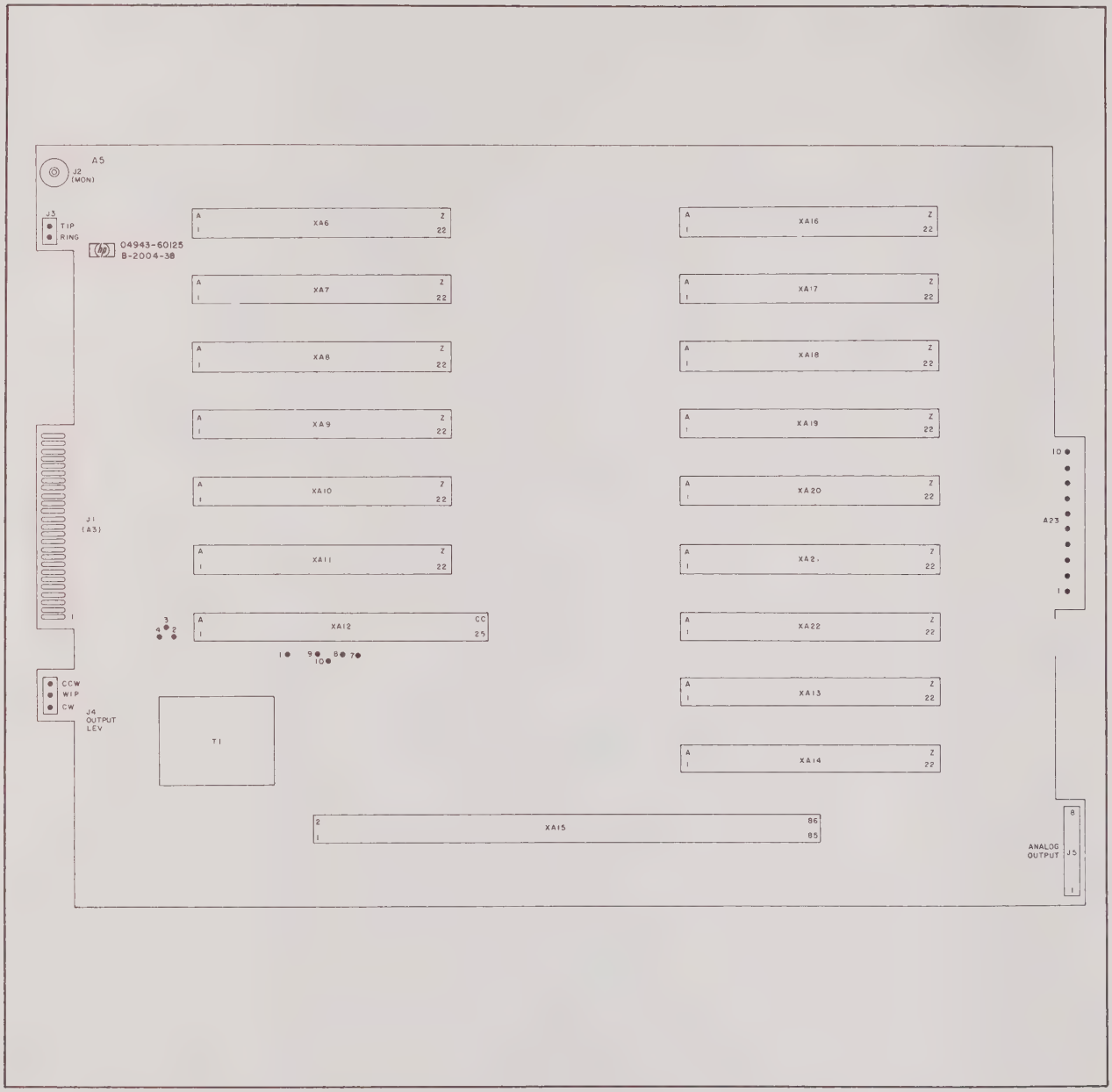

Figure 8-32. A5 Mother Component Locator

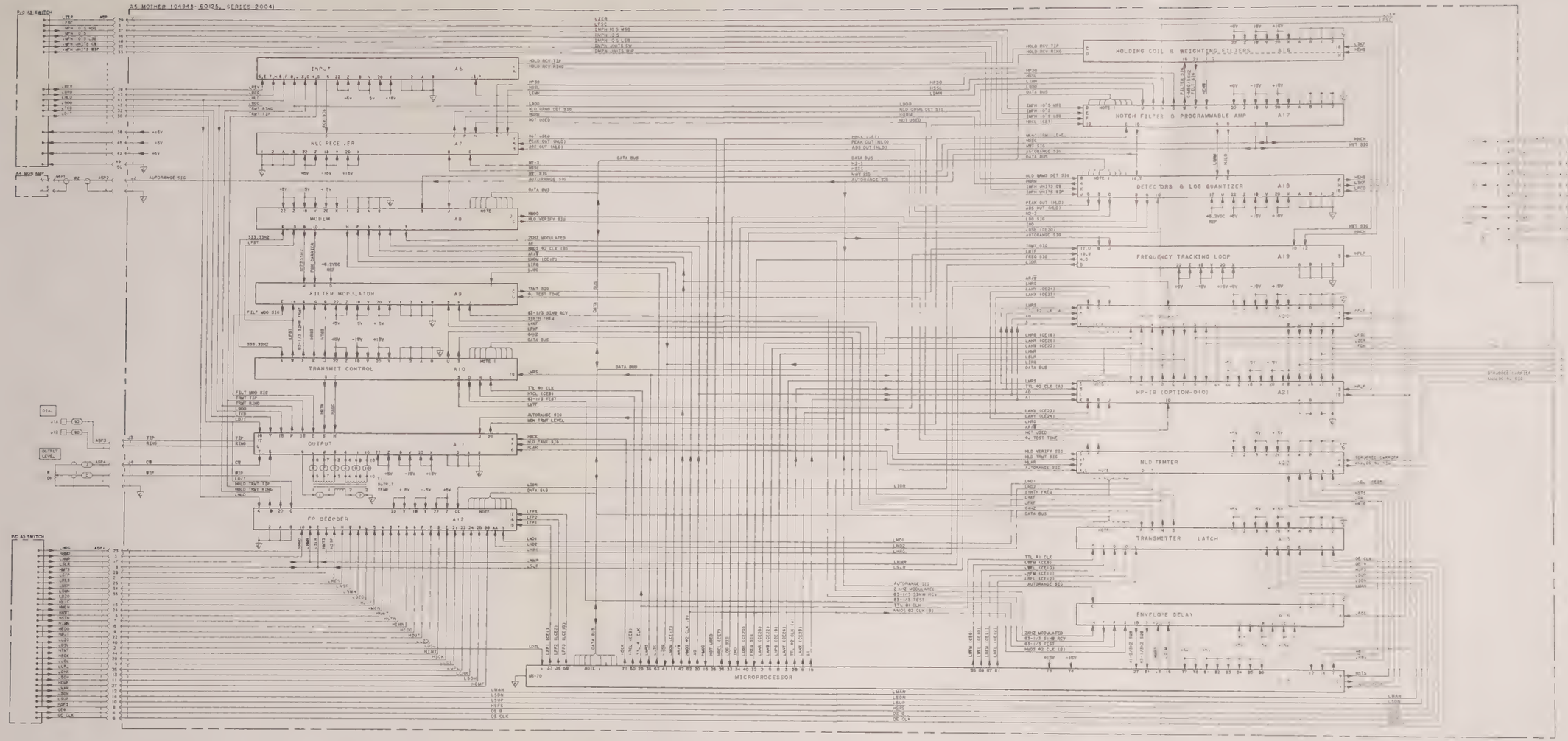

Figure 8-33. A5 Mother Schematic Diagram

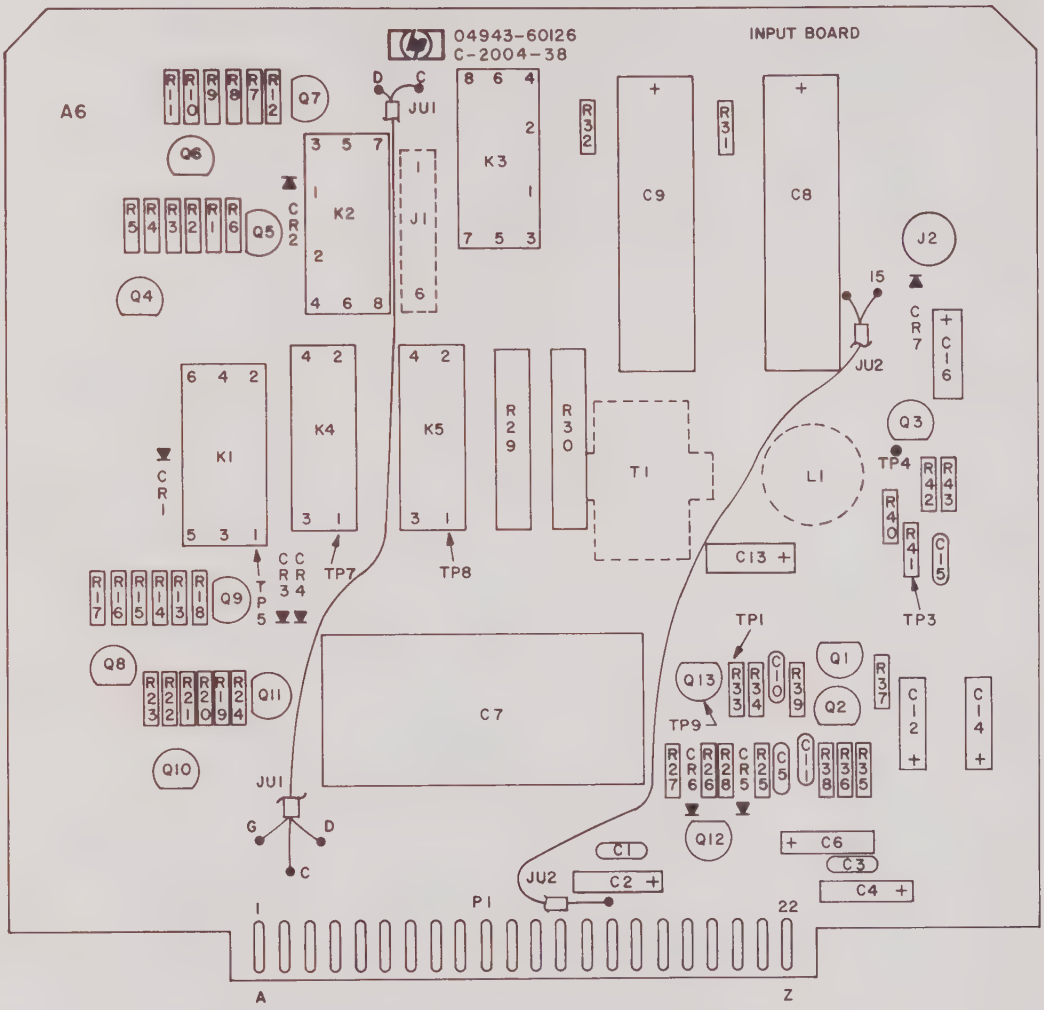

Figure 8-34. A6 Input Component Locator

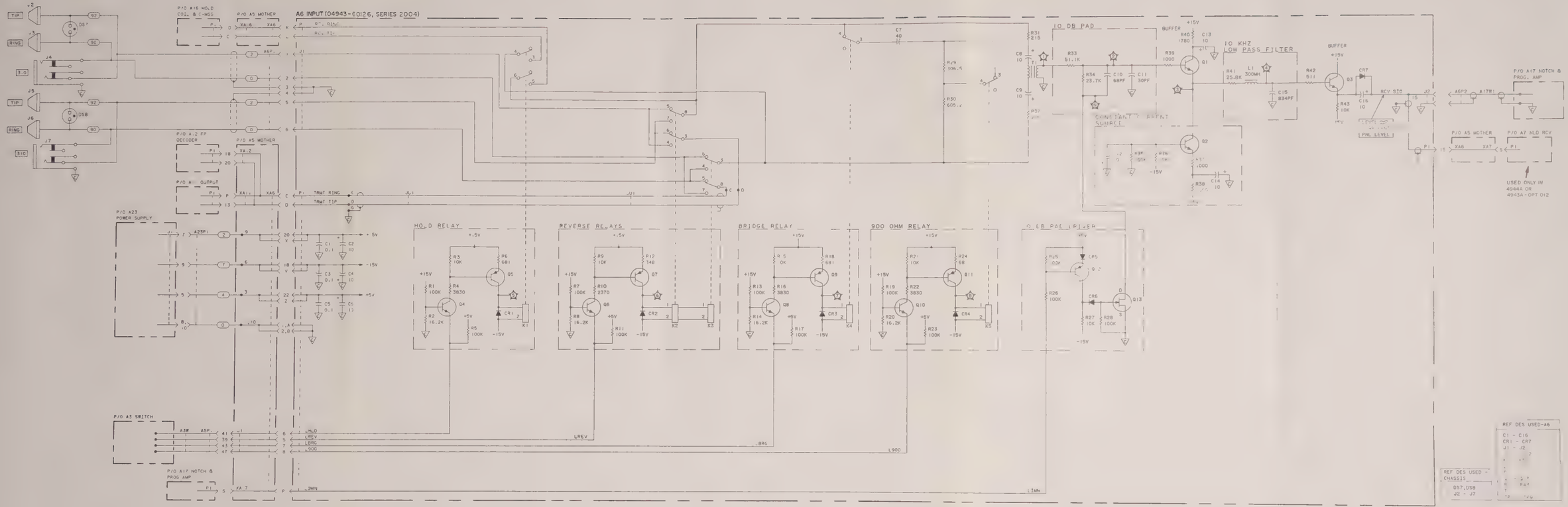

Figure 8-35. A6 Input Schematic Diagram

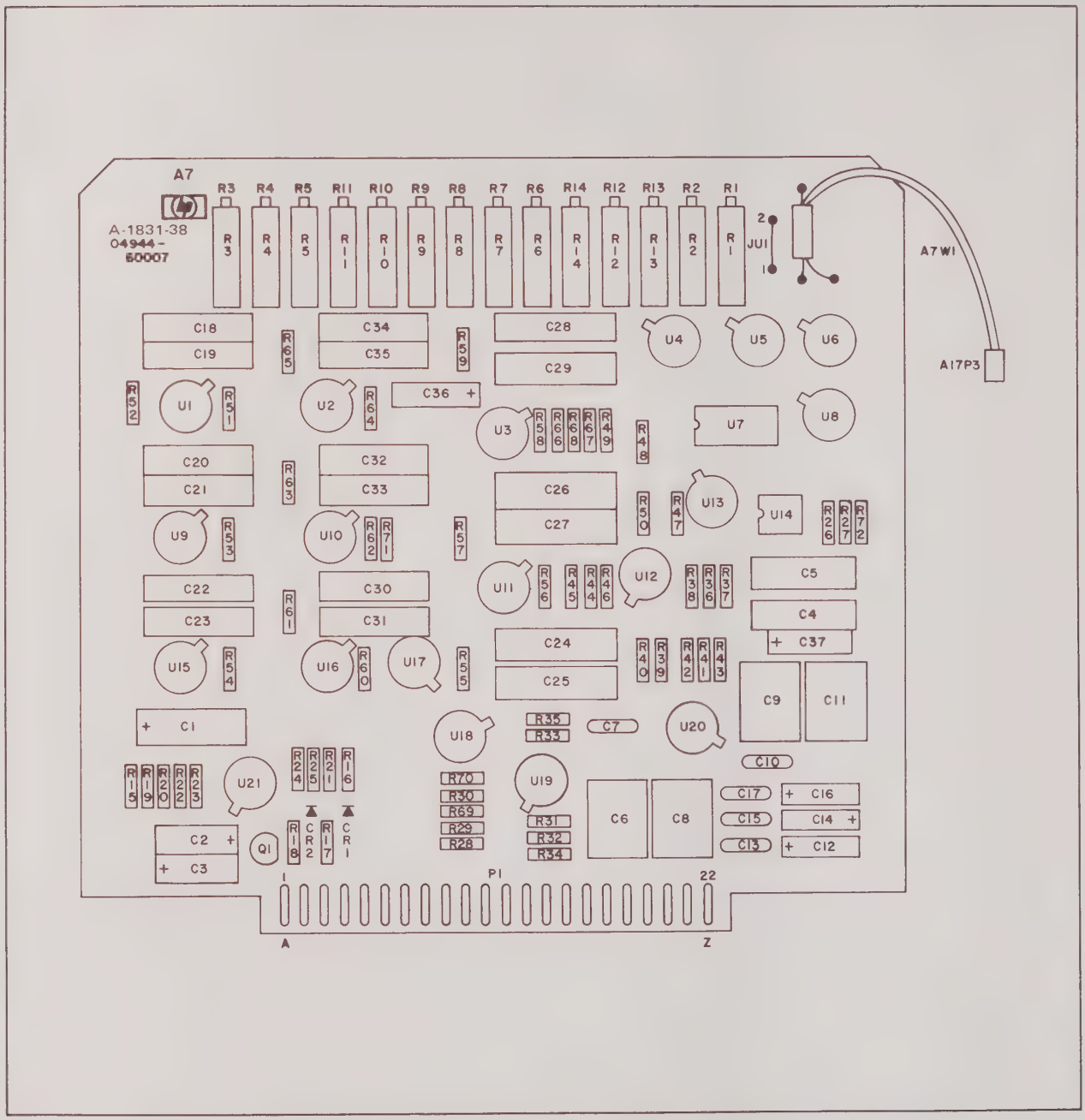

Figure 8-36. A7 Nonlinear Distortion Receiver Component Locator (Option 012)

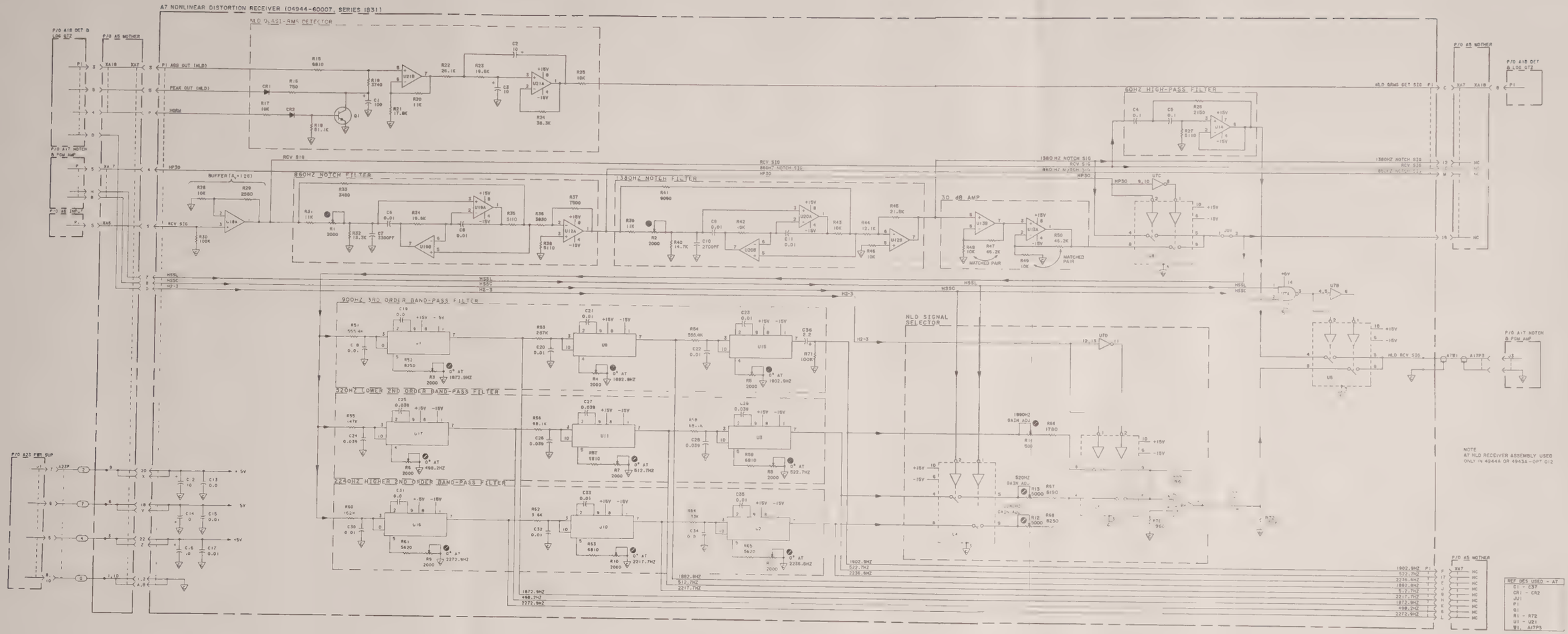

Figure 8-37. A7 Nonlinear Distortion Receiver Schematic Diagram (Option 012)

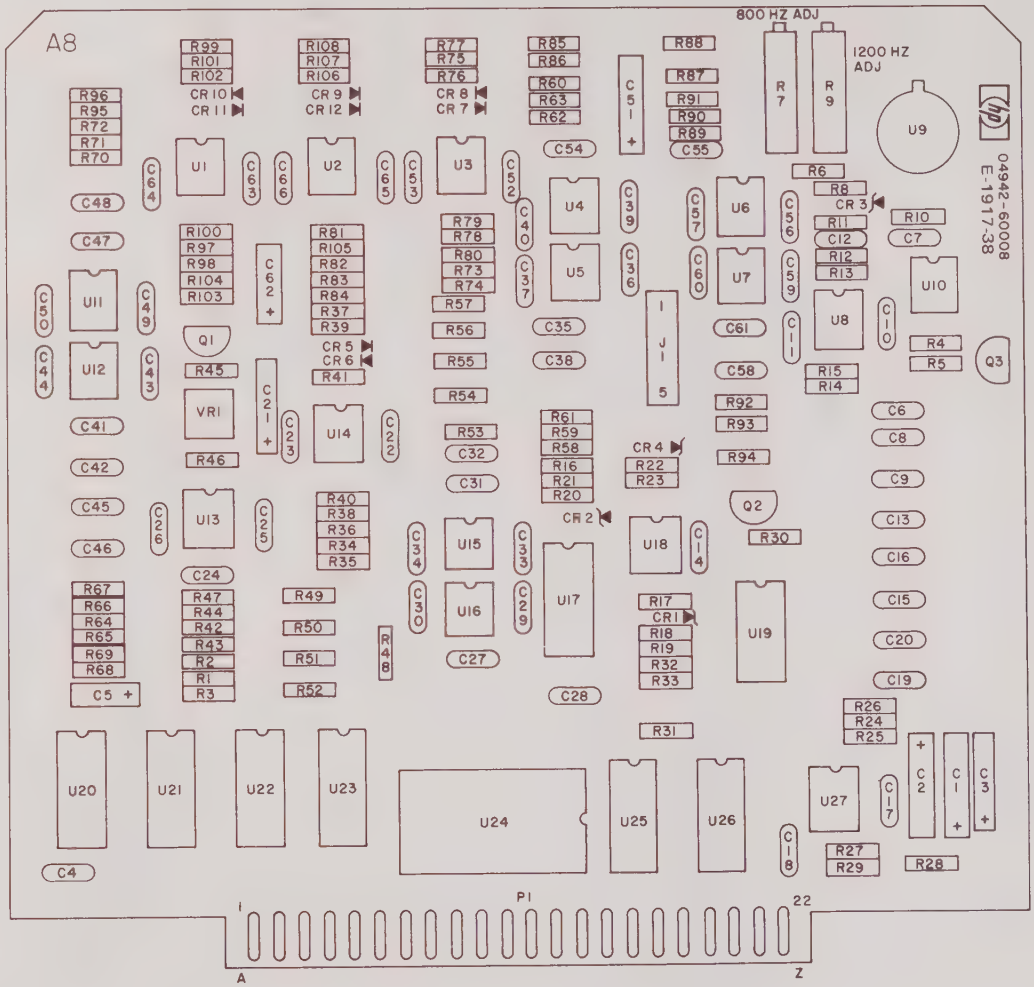

Figure 8-38. A8 Modem Component Locator

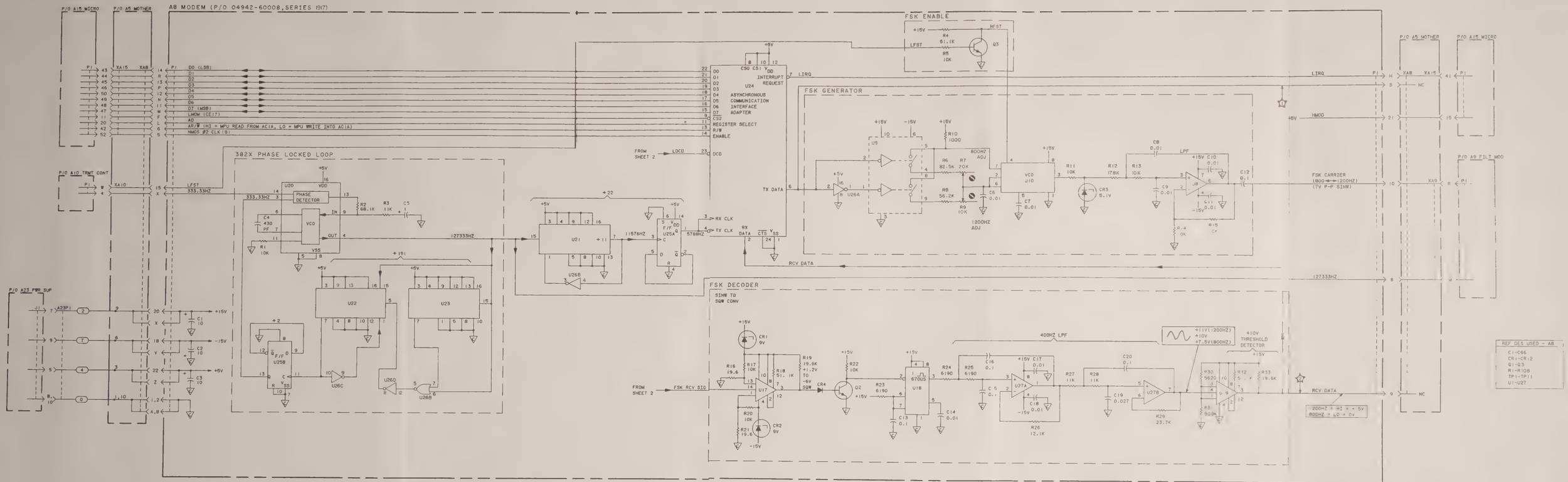

Figure 8-39. A8 Modem Schematic Diagram (1 of 2)

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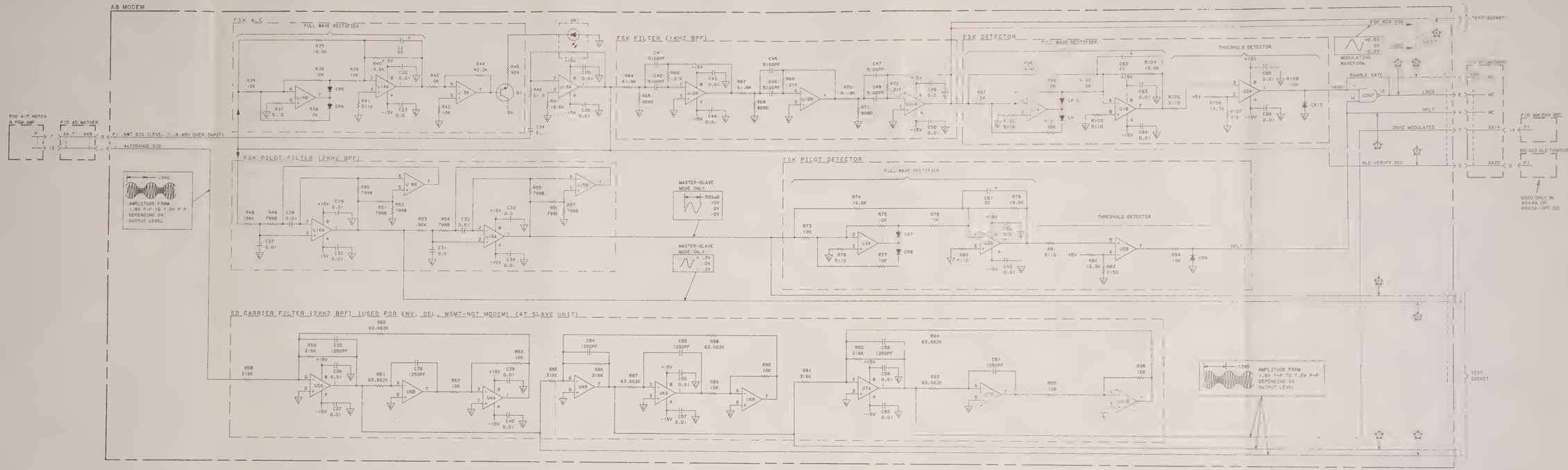


Figure 8-40. A8 Modem Schematic Diagram (2 of 2)

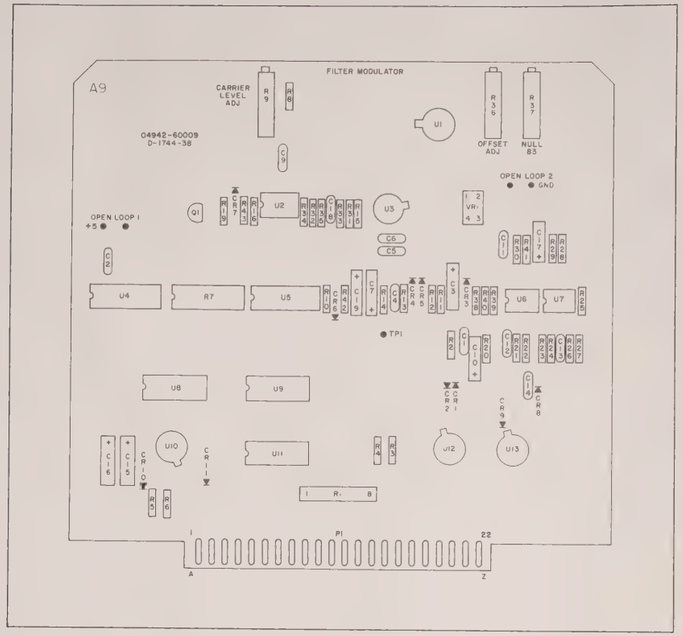


Figure 8-41. A9 Filter Modulator Component Locator

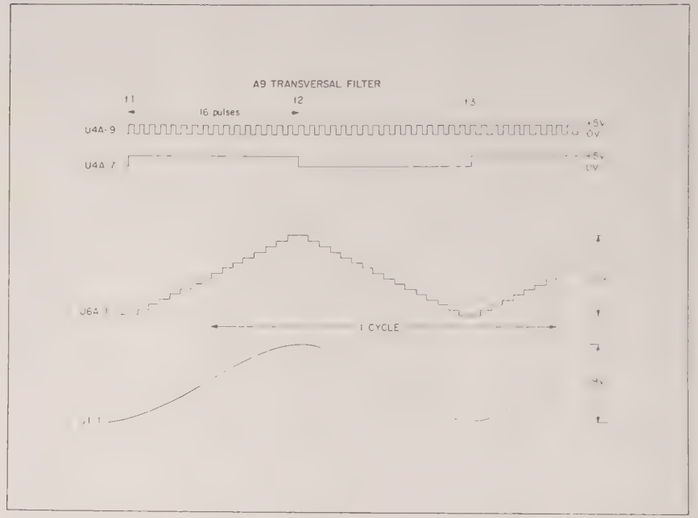
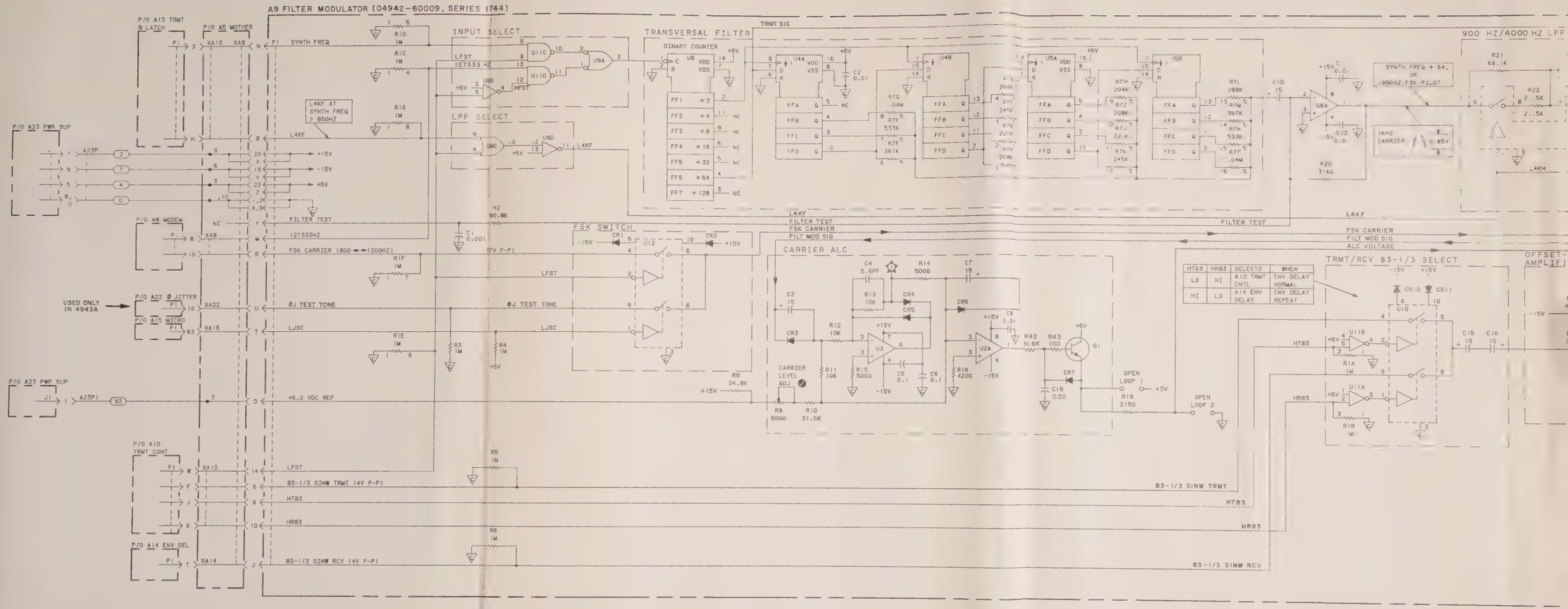


Figure 8-42. Transversal Filter Waveforms



HT83	HR83	SELECTS	WHEN
LO	HI	A10 TRMT CNTL	ENV DELAY NORMAL
HI	LO	A14 ENV DELAY	ENV DELAY REPEAT

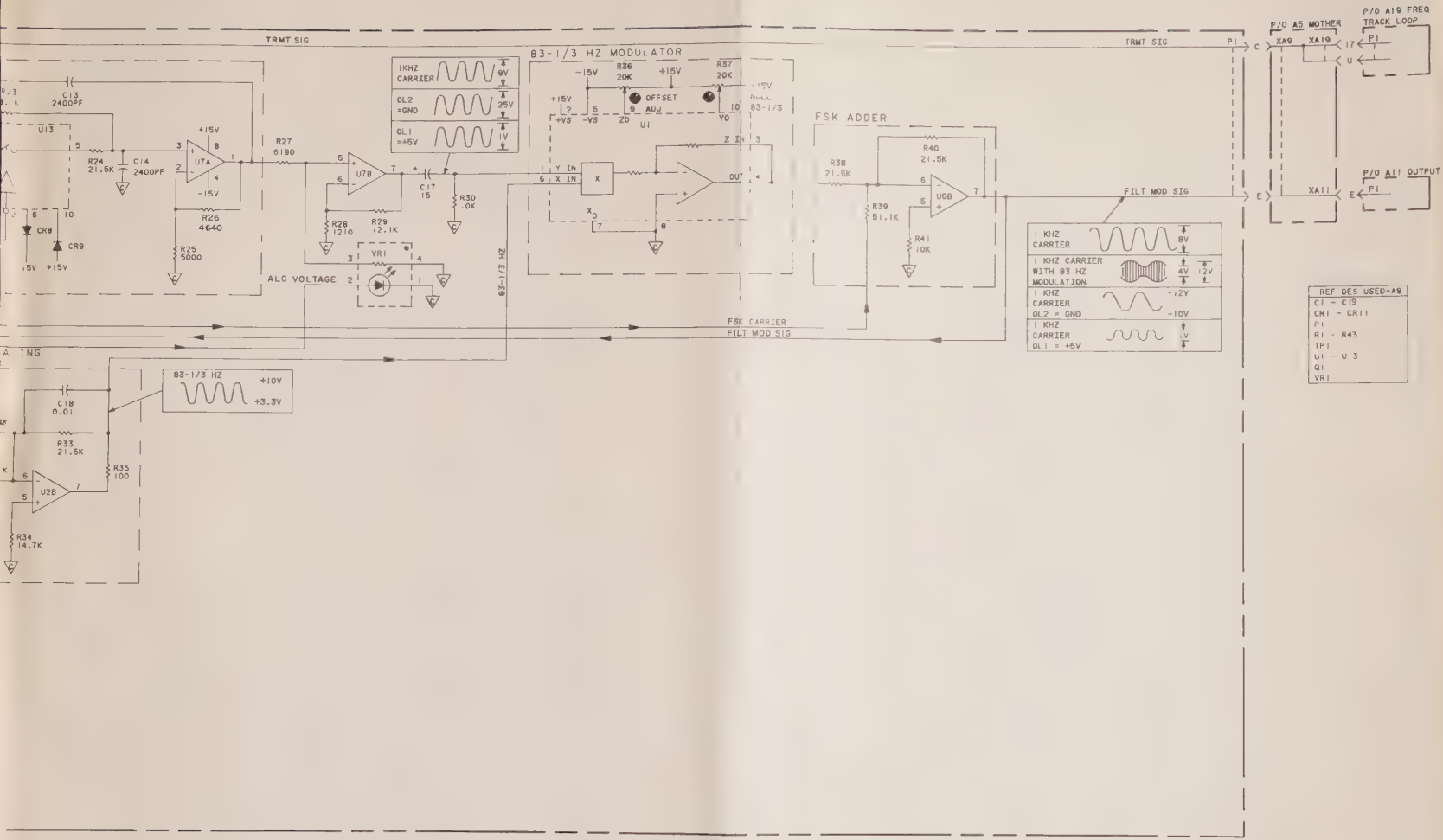


Figure 8-43. A9 Filter Modulator Schematic Diagram

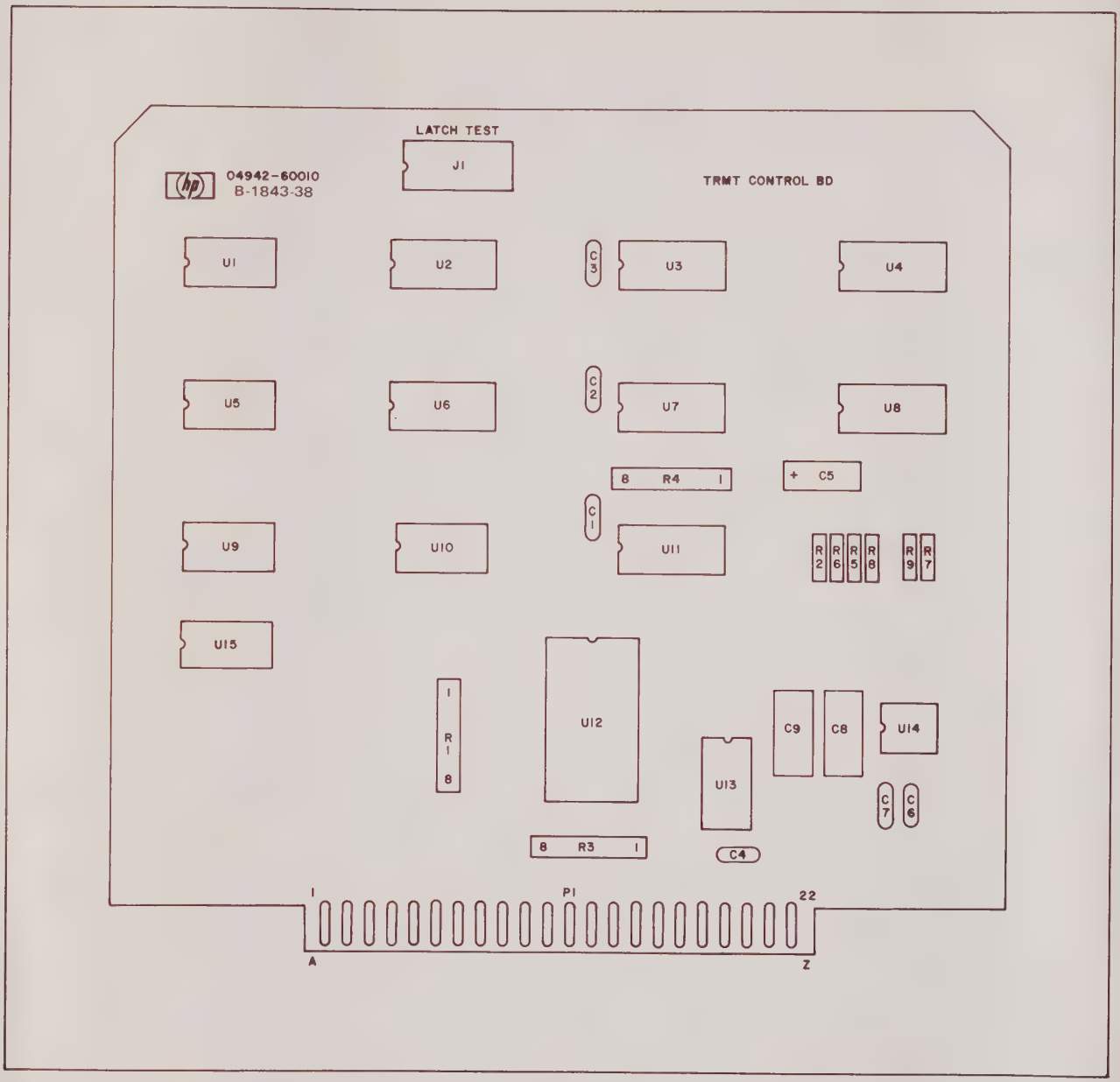


Figure 8-44. A10 Transmit Control Component Locator

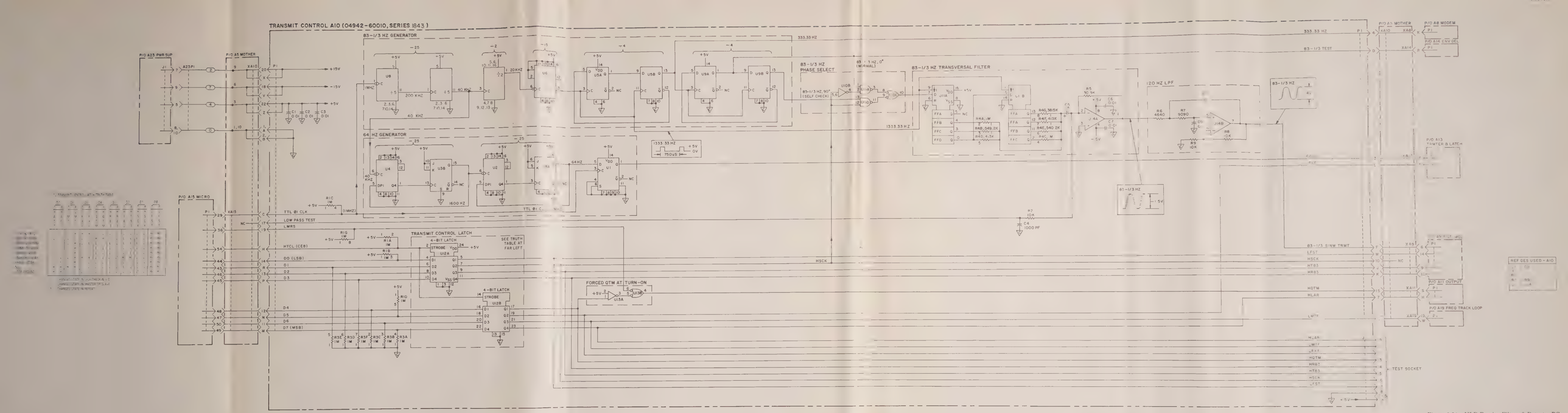


Figure 8-64. NLD Receive Filters & Detector PC Assembly A21, Schematic Diagram

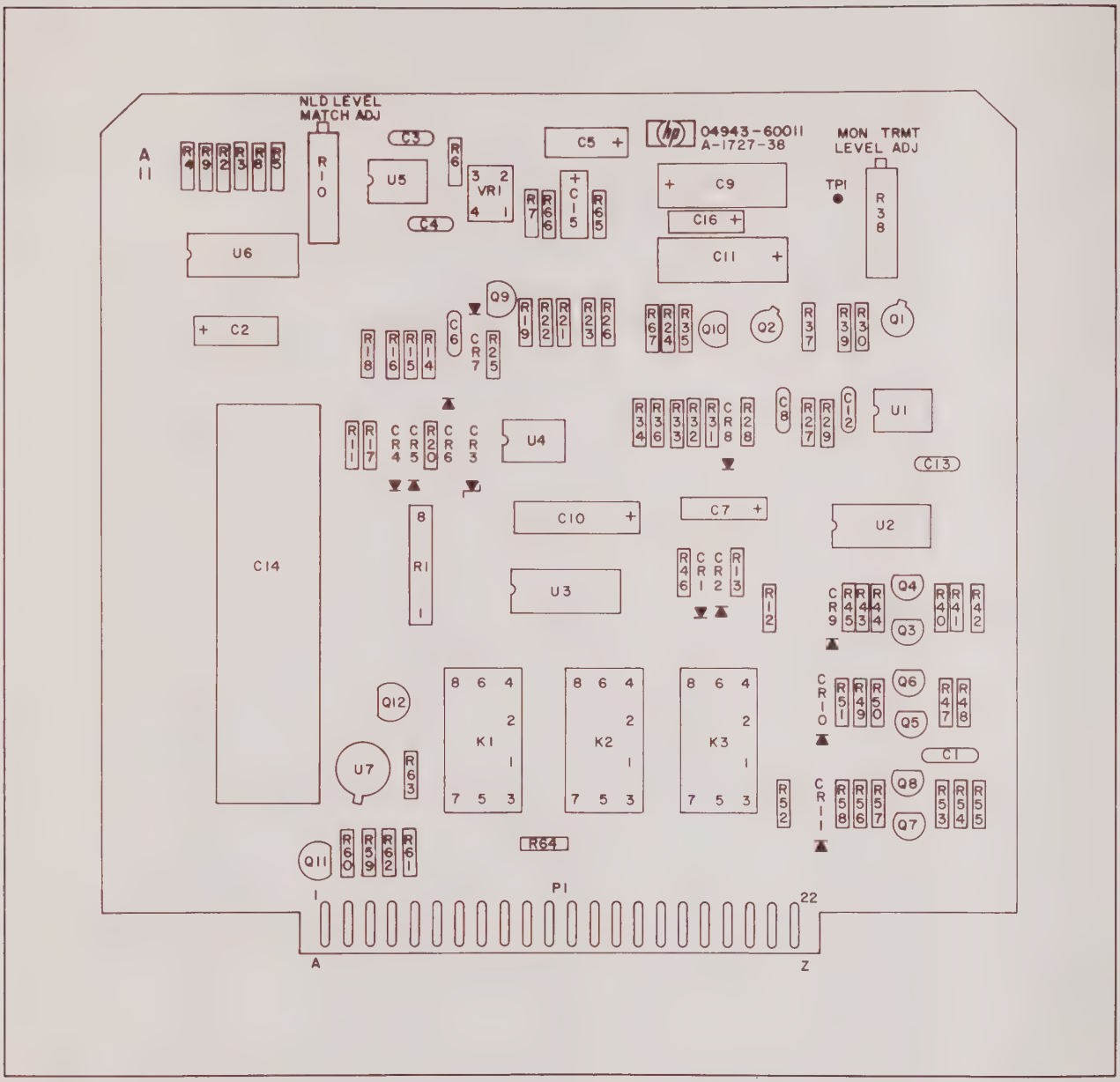


Figure 8-46. A11 Output Component Locator

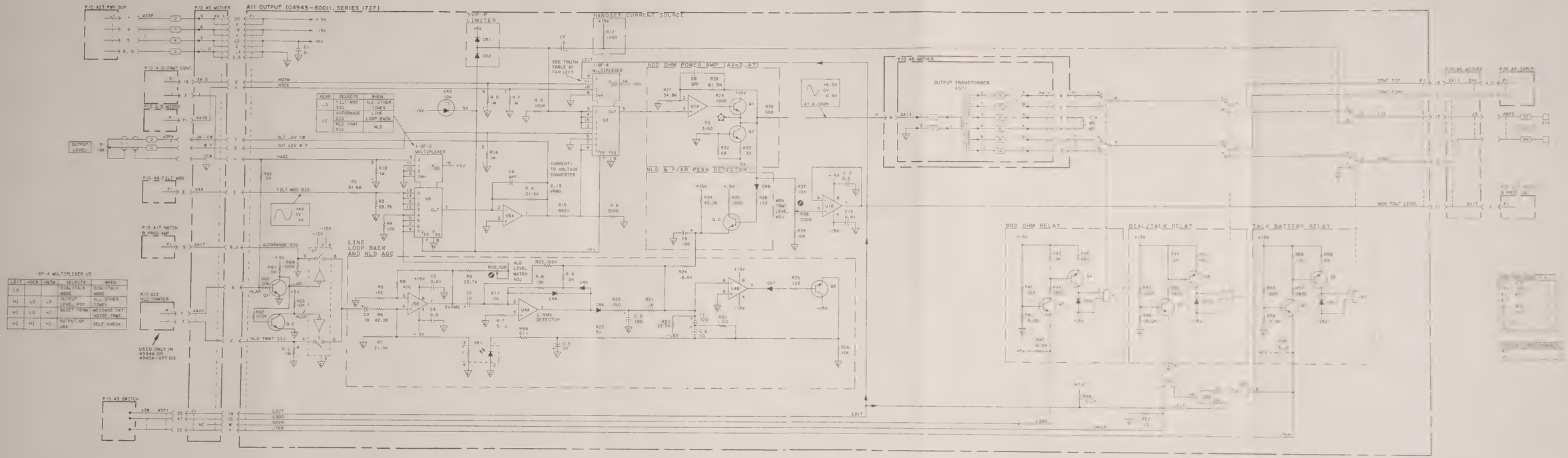


Figure 8-47. A11 Output Schematic Diagram

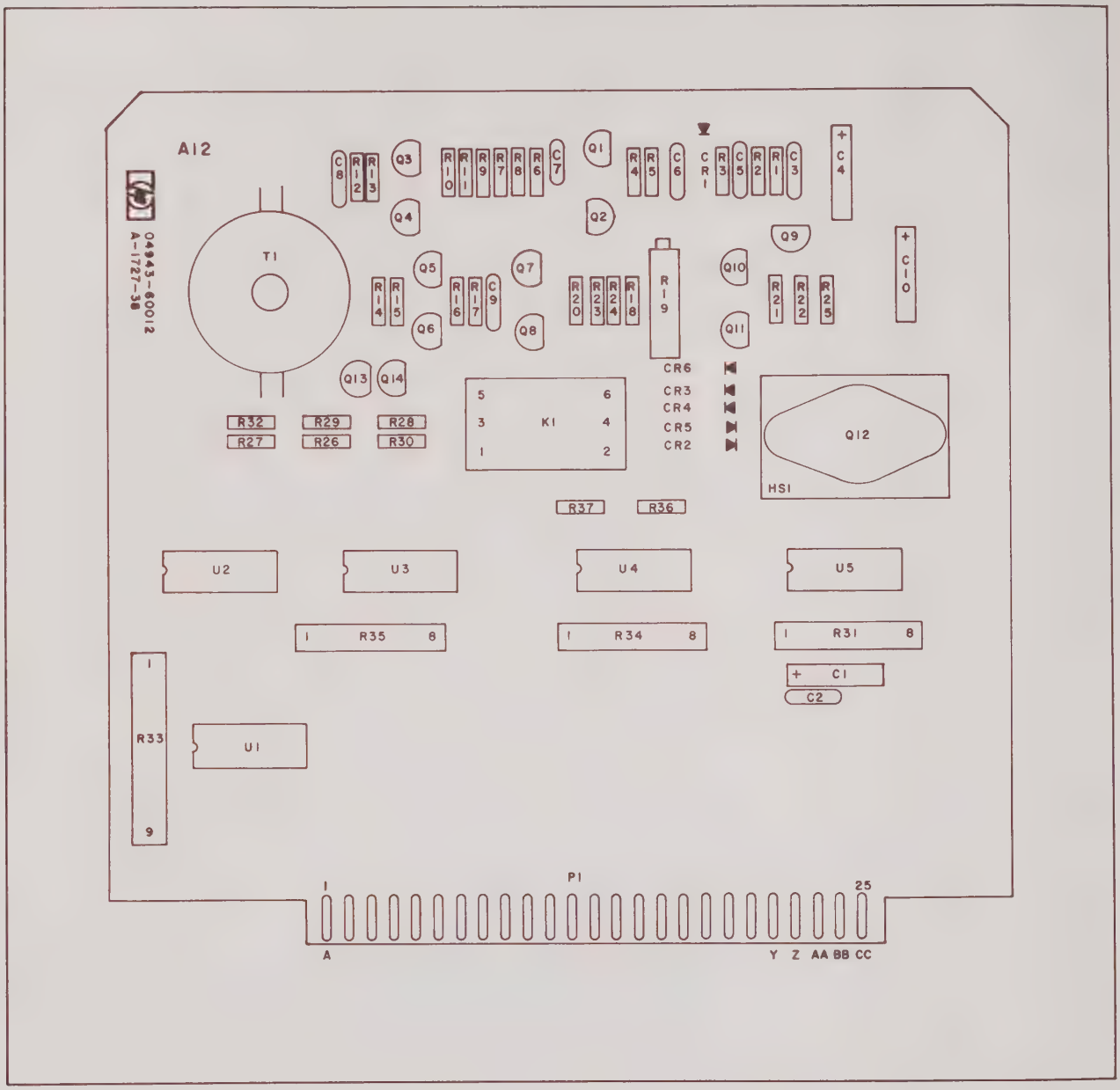


Figure 8-48. A12 Front Panel Decoder Component Locator

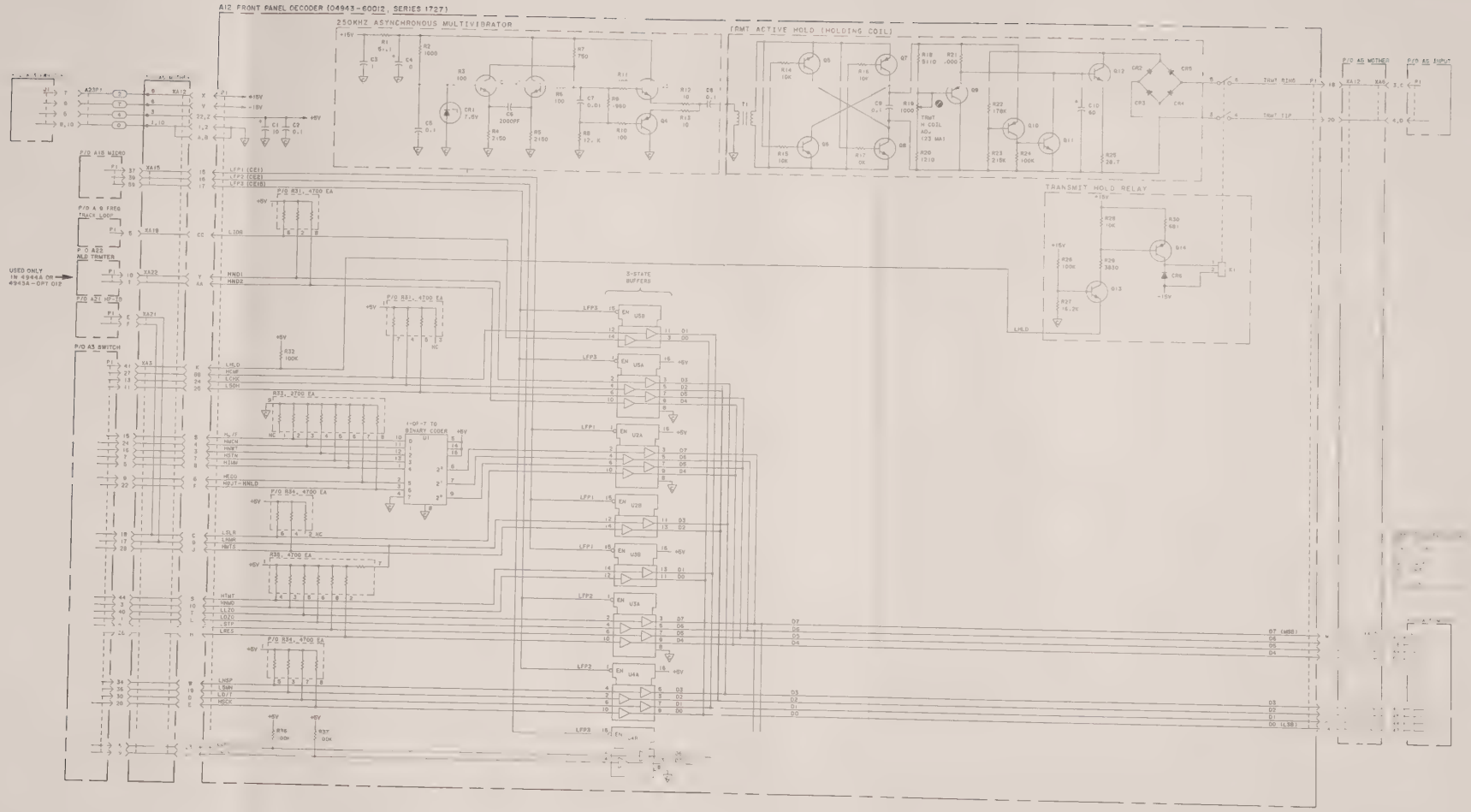


Figure 8-49. A12 Front Panel Decoder Schematic Diagram

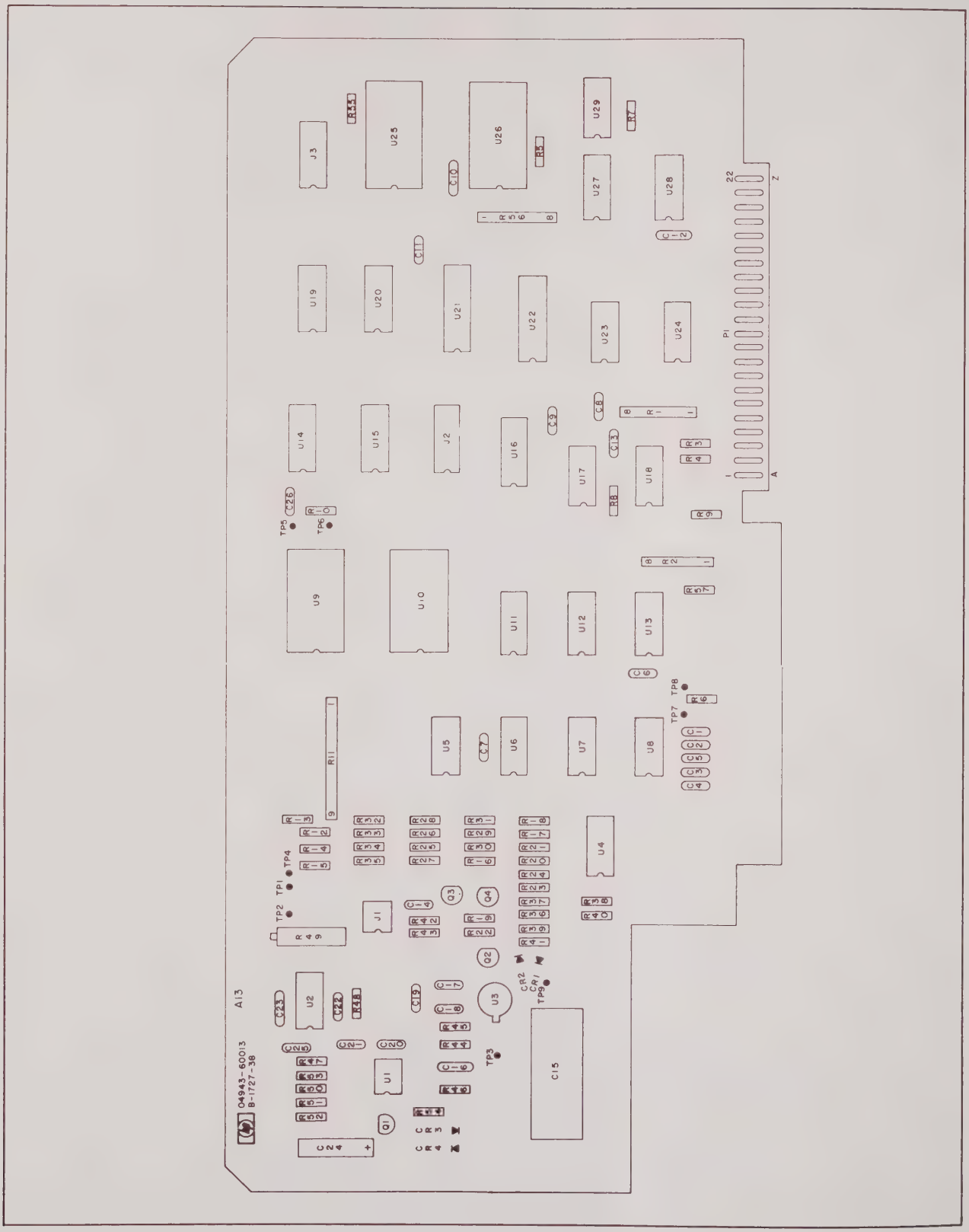


Figure 8-50. A13 Transmitter and Latch Component Locator

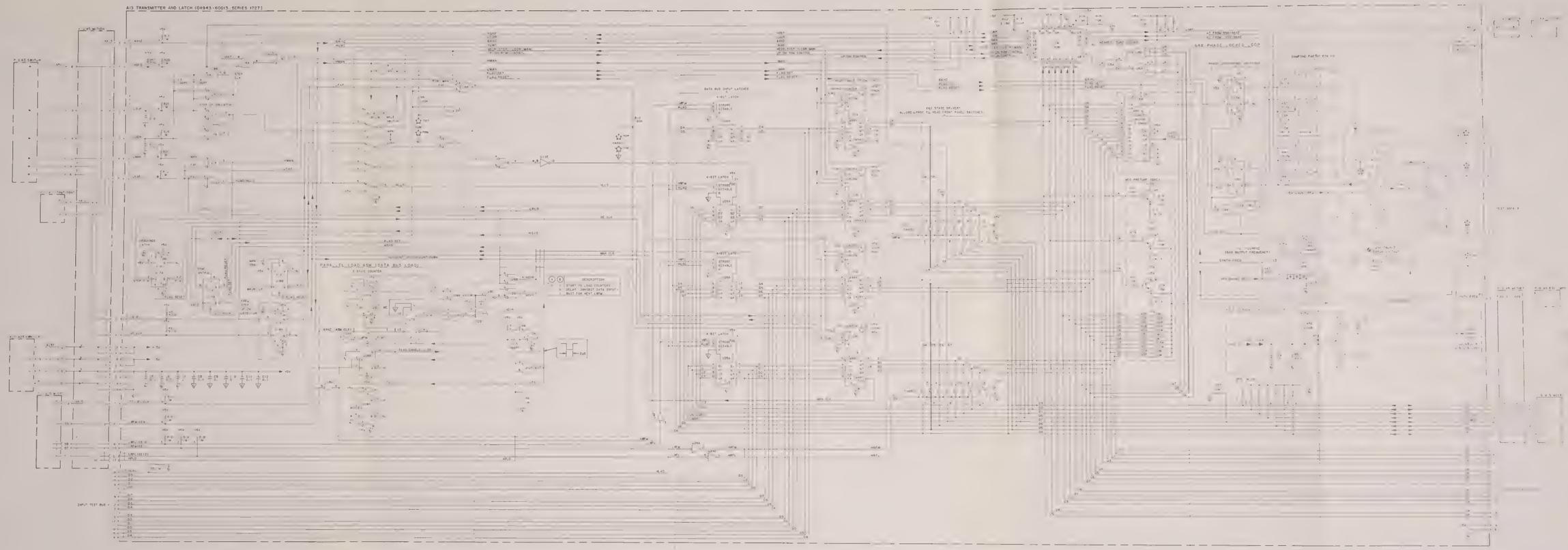


Figure 8-51. A13 Transmitter and Latch Schematic Diagram

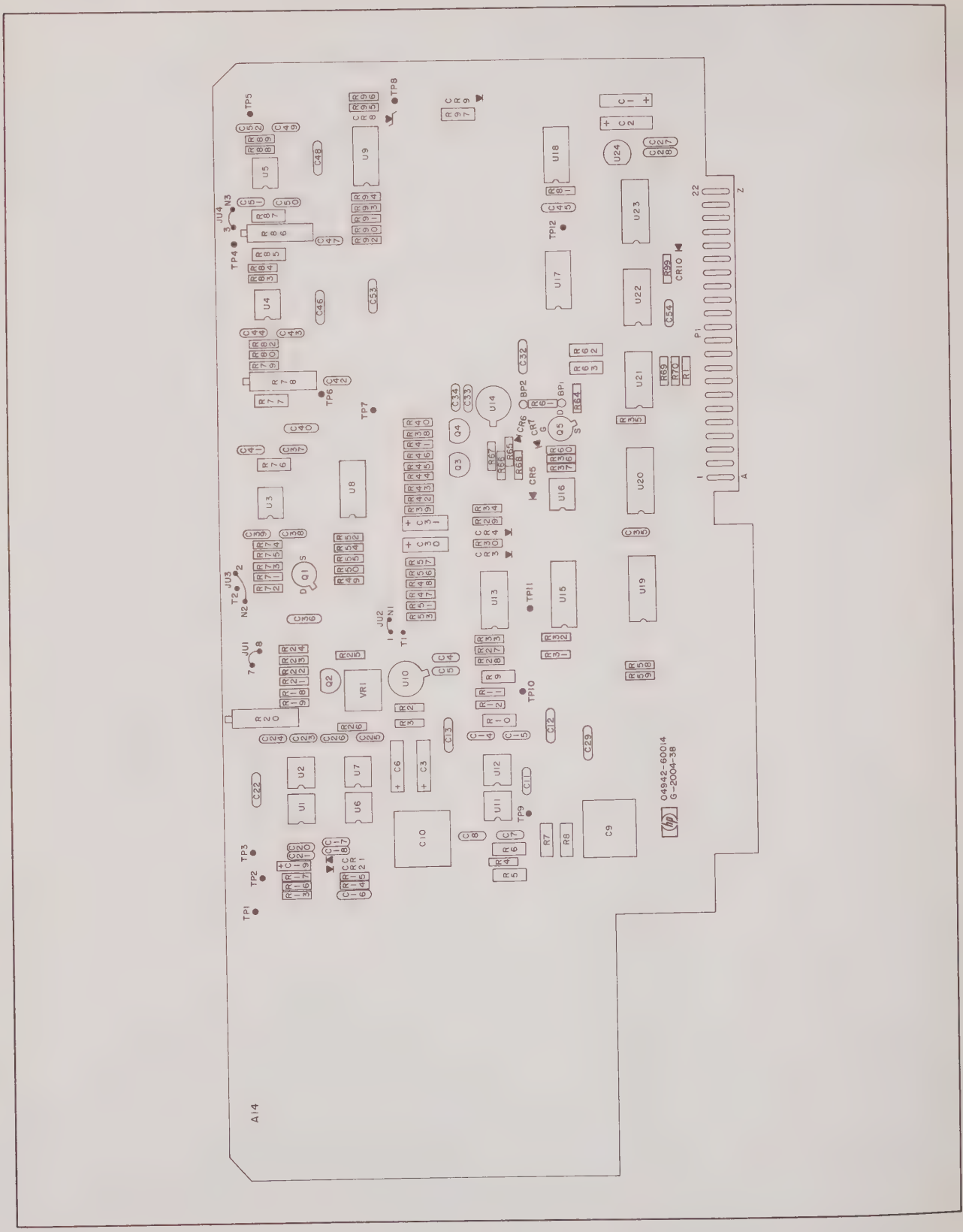


Figure 8-52. A14 Envelope Delay Component Locator

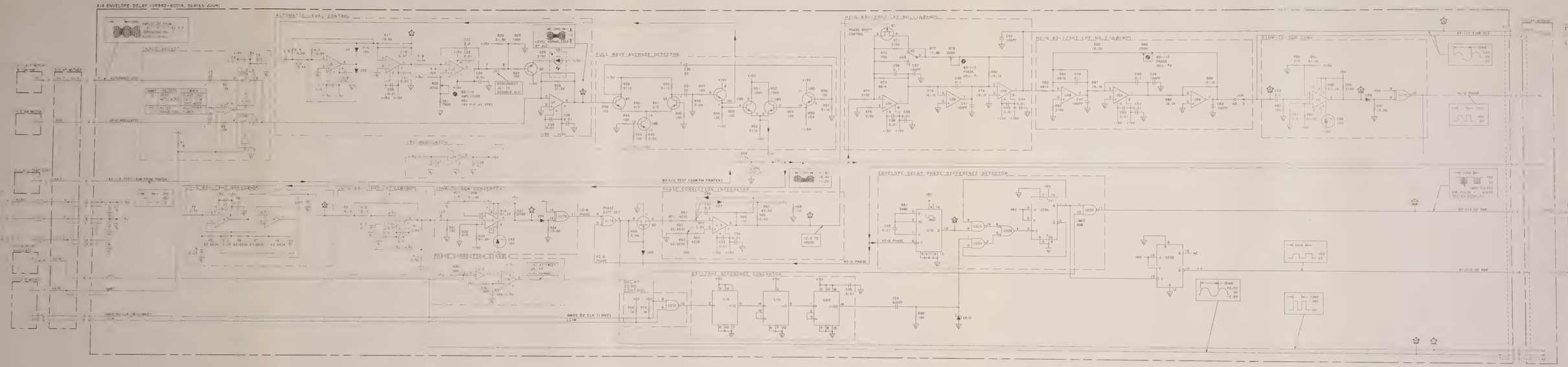


Figure 8-53. A14 Envelope Delay Schematic Diagram

Table 8-3. Free Run Test Signatures, Standard 4943A (1 of 2)

Model 5004A Signature Analyzer Setup:

a. Connect START ⎍ to S1 on A15.

b. Connect STOP ⎍ to S2 on A15.

c. Connect CLOCK ⎍ to CLK1 on A15.

Model 4943A-A15 Jumper Setup:

a. JU1 to T.

b. JU2, JU3, and JU4 removed.

c. JU5, JU6, and JU7 inserted.

3. Confirm proper setup by measuring signature at U7 pin 8. It should be "0003". This is the +5V reference signature.

Test Signatures:

Pin		Signature
U2	1	0003
	2	0000
U5	1	9A53
	2	9A50
	3	0000
	4	0003
	5	0003
	6	0000
	8	0003
	9	0000
	10	0000
	11	0003
	12	3A12
	13	3A11
U6	1	484U
	2	9A53
	3	3A11
	12	9UP1
	13	4868
	14	4FCA
	15	6U28
U7	8	0003*
	9	UUUU
	10	FFFF
	11	8484
	12	P763
	13	1U5P
	14	0356
	15	U759

Pin		Signature
U7	16	6F9A
	17	7791
	18	6321
	19	37C5
	20	6U28
	22	4FCA
	23	4868
	24	9UP1
	25	0002
U13	1	0003
	2	9A50
	8	3A11
	9	3A12
	10	0003
	11	0003*
	12	9A53
	13	0003*
U19	1	UUUU
	2	FFFF
	3	8484
	4	P763
	5	1U5P
	6	0356
	7	U759
	8	6F9A
U20	1	0003
	3	0000
	4	0000
	6	0003
	8	9UP1

Pin		Signature
U20	11	9UP2
	12	0003*
	13	9UP1
U37	1	PFP0
	2	A40H
	3	7UC1
	4	3570
	5	FPH5
	6	19H3
	7	904A
	8	7CPH
	9	5489
	10	30FH
	11	P69H
	13	A785
	14	A314
	15	856H
	16	HP67
	17	H9HH
	18	3A11
	19	3A11
	20	6F9A
	21	U759
	22	0356
	23	1U5P
U38	1	A40H
	2	A40P
	3	4PFF
	4	4PFU

*A voltage level (not a pulse train) is present. Therefore, the 5004A probe will not blink on and off.

Table 8-3. Free Run Test Signatures, Standard 4943A (2 of 2)

Test Signatures (Continued):

Pin		Signature
U38	5	84P8
	6	84PC
	8	A4U0
	9	A4U3
	10	3573
	11	3570
	12	FPH6
	13	FPH5
U39	1	24UA
	2	A60F
	3	CCHH
	4	3CHC
	5	4PFF
	6	1123
	7	84P8
	8	A4U3
	9	29H1

Pin		Signature
U39	10	C926
	11	881F
	13	09A7
	14	FFF5
	15	H2P0
	16	79HH
	17	91P0
	18	9A53
	19	9A53
	20	6F9A
	21	U759
	22	0356
	23	1U5P
U40	1	9UP2
	2	PH35
	3	9HC8

Pin		Signature
U40	4	H9AC
	5	0054
	6	4C7H
	7	1844
	8	U816
	9	PPFP
	11	712F
	12	U816
	13	1844
	14	4C7H
	15	0054
	16	H9AC
	17	9HC8
	18	PH35
	19	9UP1

Table 8-4. Software Test Signatures, Standard 4943A (1 of 2)

1. Model 5004A Signature Analyzer Setup:
   a. Connect START ⎍ to S3 on A15.
   b. Connect STOP ⎍ to S4 on A15.
   c. Connect CLOCK ⎍ to CLK2.
2. Model 4943A-A15 Jumper Setup:
   a. JU1 to N.
   b. JU2, JU3, JU4, JU5, and JU7 removed.
   c. JU6 inserted.
3. Confirm proper setup by measuring signature at U7 pin 8. It should be "F304". This is the +5V reference signature.

Test Signatures:

Pin		Signature
U2	1	0000
	2	F304
U5	1	9270
	2	5174
	3	F304
	4	0000
	5	0000
	6	F304
	8	0000
	9	F304
	10	F304
	11	0000
	12	528A
	13	918P
U6	1	03UP
	2	9270
	3	918P
	12	0000
	13	0000
	14	528A
	15	5174
U7	8	F304*
	9	1504
	10	12U1
	11	C329
	12	2F66
	13	C583
	14	2386
	15	P0AU
	16	UA1F
	17	0000
	18	0000

Pin		Signature
U7	19	0000
	20	5174
	22	528A
	23	0000
	24	0000
	25	0000
U10	2	3UC3
	3	5C49
	4	479P
	5	U850
	6	P3AC
	7	F9C4
	8	890H
	9	F9F8
	10	0000
	11	03UP
	16	0000
U13	1	0000
	2	5174
	3	3712
	4	F85F
	5	F85F
	6	0C58
	8	F304
	9	528A
	10	0000
	11	F304
	12	F304
	13	F304
U14	1	F304*
	2	F304*
	3	F304*

Pin		Signature
U15	1	F304*
	3	F304*
	6	F304
U16	5	F85F
	9	F304*
	10	7331
	11	C035
U19	1	1504
	2	12U1
	3	C329
	4	2F66
	5	C583
	6	2386
	7	P0AU
	8	UA1F
U20	1	0000
	3	F304
	4	F304
	6	0000
	8	0000
	11	F304
	12	F304
	13	0000
U21	8	3712
	9	U416
U22	2	5864
	14	5864
	19	U416
U23	3	P82U
	14	P82U

Table 8-4. Software Test Signatures, Standard 4943A (2 of 2)

Pin		Signature
U23	19	F304*
	21	7331
	23	C035
U32	8	0000
	9	0000
	10	F304
U35	1	HACH
	2	A87F
	8	C329
	9	12U1
	10	1504
	11	U416
	14	0C58
	15	732U
	16	CACA
U37	1	ACC0
	2	2C2C
	3	50FH
	4	8AP0
	5	F304*
	6	67U6
	7	117H
	8	2A38
	9	C79A
	10	F304*
	11	F304
	13	2010
U37	14	F304*
	15	F304*
	16	F304
	17	F305
	18	F304
	19	F304
	20	UA1F
	21	P0AU
	22	2386
	23	C583
U38	1	2C2C
	2	P82U
	3	9C60
	4	5864
	5	3172
	6	U276
	8	793C
	9	CA3U
	10	49P4
	11	8AP0
	12	0000*
	13	F304*
U39	1	F304*
	2	F304*
	3	APC6
	4	F304*
	5	9C60
	6	F304
U39	7	3172
	8	CA3U
	9	UU99
	10	5H4A
	11	F304*
	13	F304*
	14	HUU7
	15	92FC
	16	F304*
	17	F304*
	18	F304
	19	F304
	20	UA1F
	21	P0AU
	22	2386
	23	C583
U40	1	F304
	19	0000
U41	2	0000
	7	F304
	9	F304
	13	0000*
	14	0000
U42	3	C79A
	5	H38A
	9	108P
	11	C79A

*A voltage level (not a pulse train) is present. Therefore, the 5004A probe will not blink on and off.

Table 8-5. ROM Test Signatures, Standard 4943A (1 of 2)

1. Model 5004A Signature Analyzer Setup:

   a. Connect START ⎍ to S1 on A15.

   b. Connect STOP ⎍ to S2 on A15.

   c. Connect CLOCK ⎏ to CLK1 on A15.

2. Model 4943A-A15 Jumper Setup:

   a. JU1 to T.

   b. JU2 and JU3 removed.

   c. JU4 connected.

   d. JU5, JU6, and JU7 inserted.

3. Confirm proper setup by measuring signature at U7 pin 8. It should be "0003". This is the +5V reference signature.

Notes: 1. ROM #1 not used in either standard 4943A or 4943A-OPT 012.
2. ROM #2 not used in standard 4943A.

Test Signatures, Chip Select:

Pin		Signature	Pin		Signature	Pin		Signature
U24	3	FP33	U27	3	UPCU	U30	3	A04H
U25	3	79PA	U28	3	P933	U31	3	86C1
U26	3	P406	U29	3	UH4P			

Test Signatures, ROM #3 (CLOCK ⎍ to U18 pin 13):

Pin		Signature	Pin		Signature	Pin		Signature
U26	4	2P07	U26	7	P2AA	U26	17	H95C
	5	U787		19	F2U2		16	F0HC
	6	959U		18	PCUC			

Test Signatures, ROM #4 (CLOCK ⎍ to U18 pin 12):

Pin		Signature	Pin		Signature	Pin		Signature
U27	4	F33F	U27	7	6HFU	U27	17	A149
	5	U20C		19	9F33		16	8FU2
	6	30UP		18	59U1			

Test Signatures, ROM #5 (CLOCK ⎍ to U18 pin 11):

Pin		Signature	Pin		Signature	Pin		Signature
U28	4	7AAP	U28	7	8460	U28	17	5ACU
	5	53U8		19	H4CF		16	9H3A
	6	CAP8		18	HC03			

Test Signatures, ROM #6 (CLOCK ⎍ to U18 pin 10):

Pin		Signature	Pin		Signature	Pin		Signature
U29	4	6315	U29	7	AA54	U29	17	PC7P
	5	HF40		19	780U		16	PPA0
	6	U008		18	0U78			

Table 8-5. ROM Test Signatures, Standard 4943A (2 of 2)

Test Signatures, ROM #7 (CLOCK ⎍ to U18 pin 9):

Pin		Signature
U30	4	P984
	5	6792
	6	AP6P

Pin		Signature
U30	7	4A11
	19	05P6
	18	3116

Pin		Signature
U30	17	07CC
	16	5H53

Test Signatures, ROM #8 (CLOCK ⎍ to U18 pin 7):

Pin		Signature
U31	4	39H0
	5	72A5
	6	2652

Pin		Signature
U31	7	68F0
	19	84A8
	18	F95U

Pin		Signature
U31	17	HAUH
	16	U239

*A voltage level (not a pulse train) is present. Therefore, the 5004A probe will not blink on and off.

Table 8-6. Free Run Test Signatures, 4943A-OPT 012 (1 of 2)

1. Model 5004A Signature Analyzer Setup:
   a. Connect START ⎍ to S1 on A15.
   b. Connect STOP ⎍ to S2 on A15.
   c. Connect CLOCK ⏦ to CLK1 on A15.
2. Model 4943A-A15 Jumper Setup:
   a. JU1 to T.
   b. JU2, JU3, and JU4 removed.
   c. JU5, JU6, and JU7 inserted.
3. Confirm proper setup by measuring signature at U7 pin 8. It should be "0003". This is the +5V reference signature.

Test Signatures:

Pin		Signature
U2	1	0003
	2	0000
U5	1	9A53
	2	9A50
	3	0000
	4	0003
	5	0003
	6	0000
	8	0003
	9	0000
	10	0000
	11	0003
	12	3A12
	13	3A11
U6	1	484U
	2	9A53
	3	3A11
	12	9UP1
	13	4868
	14	4FCA
	15	6U28
U7	8	0003*
	9	UUUU
	10	FFFF
	11	8484
	12	P763
	13	1U5P
	14	0356
	15	U759

Pin		Signature
U7	16	6F9A
	17	7791
	18	6321
	19	37C5
	20	6U28
	22	4FCA
	23	4868
	24	9UP1
	25	0002
U13	1	0003
	2	9A50
	8	3A11
	9	3A12
	10	0003
	11	0003*
	12	9A53
	13	0003*
U19	1	UUUU
	2	FFFF
	3	8484
	4	P763
	5	1U5P
	6	0356
	7	U759
	8	6F9A
U20	1	0003
	3	0000
	4	0000
	6	0003
	8	9UP1

Pin		Signature
U20	11	9UP2
	12	0003*
	13	9UP1
U37	1	PFP0
	2	A40H
	3	7UC1
	4	3570
	5	FPH5
	6	19H3
	7	904A
	8	7CPH
	9	5489
	10	30FH
	11	P69H
	13	A785
	14	A314
	15	856H
	16	HP67
	17	H9HH
	18	3A11
	19	3A11
	20	6F9A
	21	U759
	22	0356
	23	1U5P
U38	1	A40H
	2	A40P
	3	4PFF
	4	4PFU

*A voltage level (not a pulse train) is present. Therefore, the 5004A probe will not blink on and off.

Table 8-6. Free Run Test Signatures, 4943A-OPT 012 (2 of 2)

Test Signatures (Continued):

Pin		Signature
U38	5	84P8
	6	84PC
	8	A4U0
	9	A4U3
	10	3573
	11	3570
	12	FPH6
	13	FPH5
U39	1	24UA
	2	A60F
	3	CCHH
	4	3CHC
	5	4PFF
	6	1123
	7	84P8
	8	A4U3
	9	29H1

Pin		Signature
U39	10	C926
	11	881F
	13	09A7
	14	FFF5
	15	H2P0
	16	79HH
	17	91P0
	18	9A53
	19	9A53
	20	6F9A
	21	U759
	22	0356
	23	1U5P
U40	1	9UP2
	2	689F
	3	4533

Pin		Signature
U40	4	C1U9
	5	CFC9
	6	FAAP
	7	HAA5
	8	66U6
	9	013F
	11	013F
	12	66U6
	13	HAA5
	14	FAAP
	15	CFC9
	16	C1U9
	17	4533
	18	689F
	19	9UP1

Table 8-7. Software Test Signatures, 4943A-OPT 012 (1 of 2)

1. Model 5004A Signature Analyzer Setup:
   a. Connect START ⎍ to S3 on A15.
   b. Connect STOP ⎍ to S4 on A15.
   c. Connect CLOCK ⎍ to CLK2.
2. Model 4943A-A15 Jumper Setup:
   a. JU1 to N.
   b. JU2, JU3, JU4, JU5, and JU7 removed.
   c. JU6 inserted.
3. Confirm proper setup by measuring signature at U7 pin 8. It should be "F304". This is the +5V reference signature.

Test Signatures:

Pin		Signature
U2	1	0000
	2	F304
U5	1	9270
	2	5174
	3	F304
	4	0000
	5	0000
	6	F304
	8	0000
	9	F304
	10	F304
	11	0000
	12	528A
	13	918P
U6	1	03UP
	2	9270
	3	918P
	12	0000
	13	0000
	14	528A
	15	5174
U7	8	F304*
	9	1504
	10	12U1
	11	C329
	12	2F66
	13	C583
	14	2386
	15	P0AU
	16	UA1F
	17	0000
	18	0000

Pin		Signature
U7	19	0000
	20	5174
	22	528A
	23	0000
	24	0000
	25	0000
U10	2	UAA7
	3	9P5H
	4	479P
	5	U850
	6	412H
	7	6C32
	8	890H
	9	F9F8
	10	0000
	11	03UP
	16	0000
U13	1	0000
	2	5174
	3	3712
	4	F85F
	5	F85F
	6	0C58
	8	F304
	9	528A
	10	0000
	11	F304
	12	F304
	13	F304
U14	1	F304*
	2	F304*
	3	F304*

Pin		Signature
U15	1	F304*
	3	F304*
	6	0000*
U16	5	F85F
	9	F304*
	10	7331
	11	C035
U19	1	1504
	2	12U1
	3	C329
	4	2F66
	5	C583
	6	2386
	7	P0AU
	8	UA1F
U20	1	0000
	3	F304
	4	F304
	6	0000
	8	0000
	11	F304
	12	F304
	13	0000
U21	8	3712
	9	U416
U22	2	5864
	14	5864
	19	U416
U23	3	P82U
	14	P82U

Table 8-7. Software Test Signatures, 4943A-OPT 012 (2 of 2)

Pin		Signature
U23	19	F304*
	21	7331
	23	C035
U32	8	0000
	9	0000
	10	F304
U35	1	HACH
	2	A87F
	8	C329
	9	12U1
	10	1504
	11	U416
	14	0C58
	15	732U
	16	CACA
U37	1	ACC0
	2	2C2C
	3	50FH
	4	8AP0
	5	F304*
	6	67U6
	7	117H
	8	2A38
	9	C79A
	10	F304*
	11	F304
	13	2010

Pin		Signature
U37	14	F304*
	15	F304*
	16	F304
	17	F305
	18	F304
	19	F304
	20	UA1F
	21	P0AU
	22	2386
	23	C583
U38	1	2C2C
	2	P82U
	3	9C60
	4	5864
	5	3172
	6	U276
	8	793C
	9	CA3U
	10	49P4
	11	8AP0
	12	0000*
	13	F304*
U39	1	F304*
	2	F304*
	3	APC6
	4	F304*
	5	9C60
	6	F304

Pin		Signature
U39	7	3172
	8	CA3U
	9	UU99
	10	5H4A
	11	F304*
	13	F304*
	14	HUU7
	15	92FC
	16	F304*
	17	F304*
	18	F304
	19	F304
	20	UA1F
	21	P0AU
	22	2386
	23	C583
U40	1	F304
	19	0000
U41	2	0000
	7	F304
	9	F304
	13	0000*
	14	0000
U42	3	C79A
	5	H38A
	9	108P
	11	C79A

*A voltage level (not a pulse train) is present. Therefore, the 5004A probe will not blink on and off.

Table 8-8. ROM Test Signatures, 4943A-OPT 012 (1 of 2)

1. Model 5004A Signature Analyzer Setup:
   a. Connect START ⎍ to S1 on A15.
   b. Connect STOP ⎍ to S2 on A15.
   c. Connect CLOCK ⏦ to CLK1 on A15.
2. Model 4943A-A15 Jumper Setup:
   a. JU1 to T.
   b. JU2 and JU3 removed.
   c. JU4 connected.
   d. JU5, JU6, and JU7 inserted.
3. Confirm proper setup by measuring signature at U7 pin 8. It should be "0003". This is the +5V reference signature.

Notes: 1. ROM #1 not used in either standard 4943A or 4943A-OPT 012.
2. ROM #3 not used in 4943A-OPT 012.

Test Signatures, Chip Select:

Pin		Signature
U24	3	FP33
U25	3	79PA
U26	3	P406

Pin		Signature
U27	3	UPCU
U28	3	P933
U29	3	UH4P

Pin		Signature
U30	3	A04H
U31	3	86C1

Test Signatures, ROM #2 (CLOCK ⎍ to U18 pin 14):

Pin		Signature
U25	4	2131
	5	172H
	6	7362

Pin		Signature
U25	7	P275
	19	47PP
	18	70P2

Pin		Signature
U25	17	3UUU
	16	5HCU

Test Signatures, ROM #4 (CLOCK ⎍ to U18 pin 12):

Pin		Signature
U27	4	F33F
	5	U20C
	6	C0A8

Pin		Signature
U27	7	6HFU
	19	9F33
	18	59U1

Pin		Signature
U27	17	A149
	16	8FU2

Test Signatures, ROM #5 (CLOCK ⎍ to U18 pin 11):

Pin		Signature
U28	4	7AAP
	5	53U8
	6	CAP8

Pin		Signature
U28	7	8460
	19	H4CF
	18	HC03

Pin		Signature
U28	17	5ACU
	16	9H3A

Test Signatures, ROM #6 (CLOCK ⎍ to U18 pin 10):

Pin		Signature
U29	4	6315
	5	HF40
	6	U008

Pin		Signature
U29	7	AA54
	19	780U
	18	0U78

Pin		Signature
U29	17	PC7P
	16	PPA0

Table 8-8. ROM Test Signatures, 4943A-OPT 012 (2 of 2)

Test Signatures, ROM #7 (CLOCK ⎍ to U18 pin 9):

Pin		Signature
U30	4	P984
	5	6792
	6	AP6P

Pin		Signature
U30	7	4A11
	19	05P6
	18	3116

Pin		Signature
U30	17	07CC
	16	5H53

Test Signatures, ROM #8 (CLOCK ⎍ to U18 pin 7):

Pin		Signature
U31	4	39H0
	5	72A5
	6	2652

Pin		Signature
U31	7	68F0
	19	84A8
	18	F95U

Pin		Signature
U31	17	HAUH
	16	U239

*A voltage level (not a pulse train) is present. Therefore, the 5004A probe will not blink on and off.

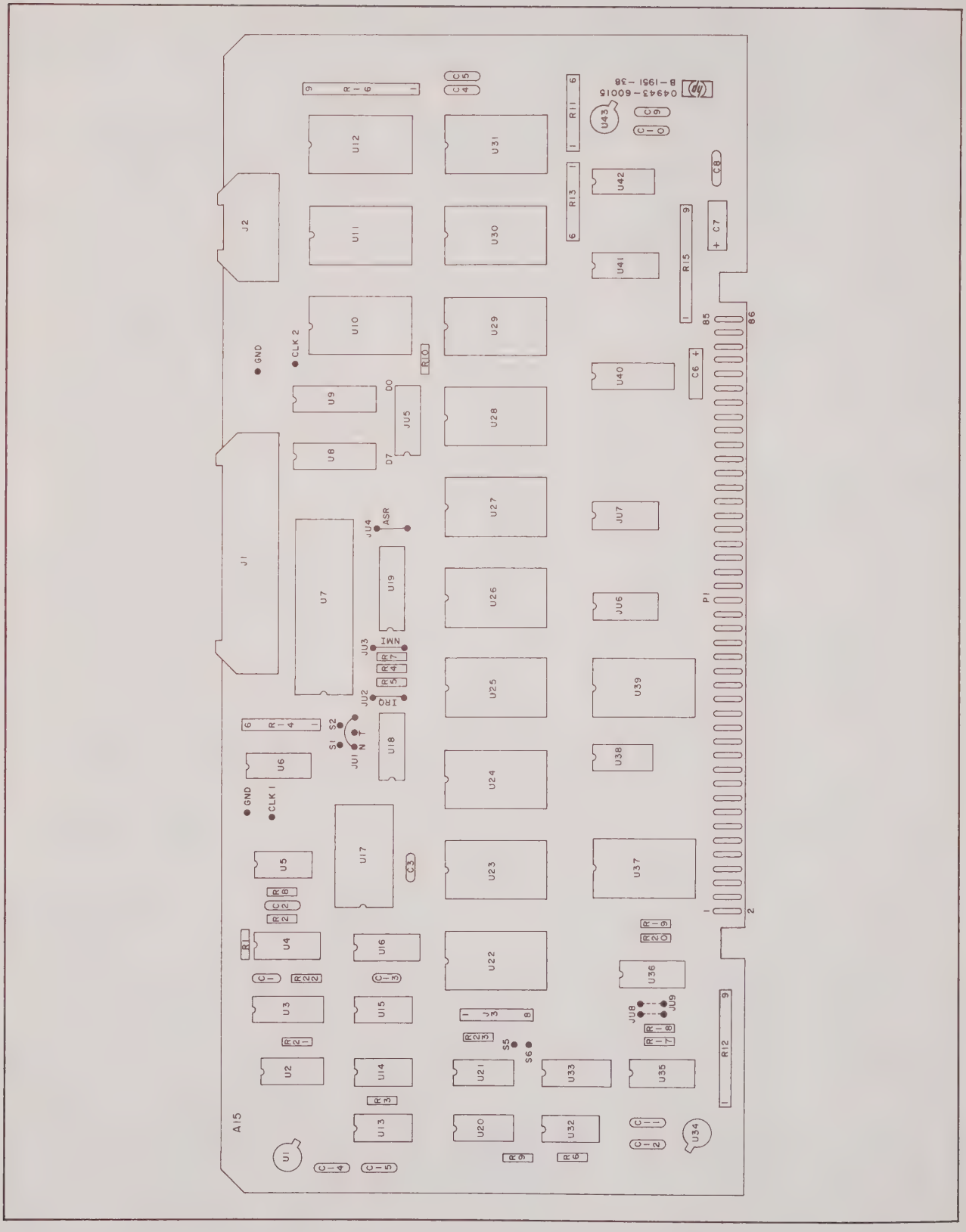


Figure 8-54. A15 Microprocessor Component Locator

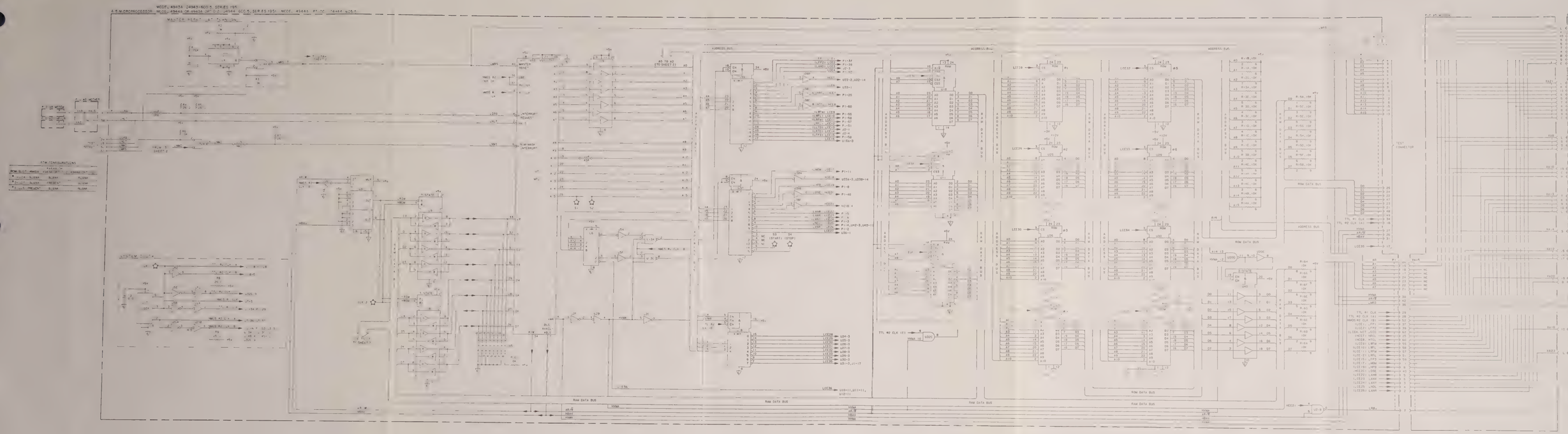


Figure 8-55. A15 Microprocessor Schematic Diagram (1 of 2)

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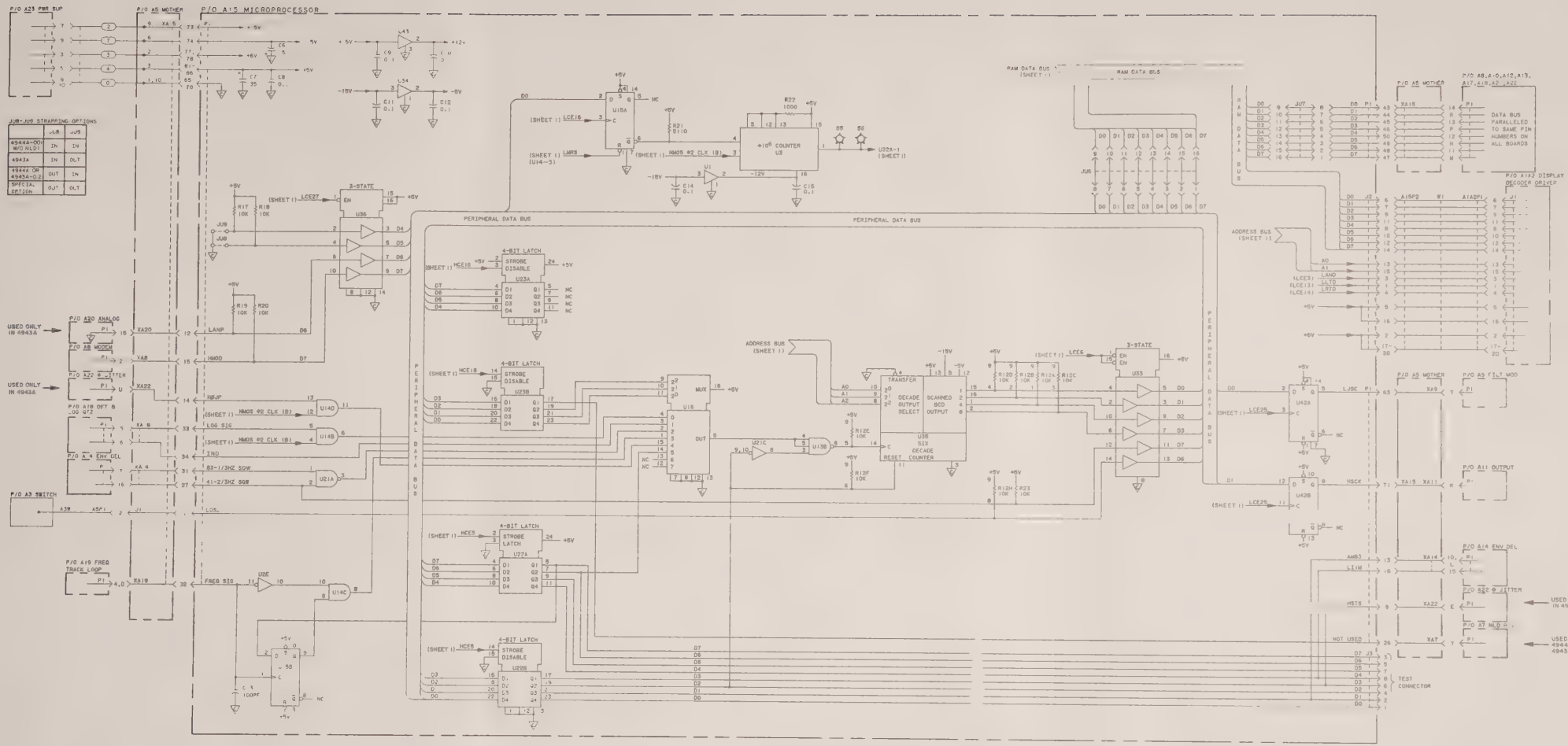


Figure 8-56. A15 Microprocessor Schematic Diagram (2 of 2)

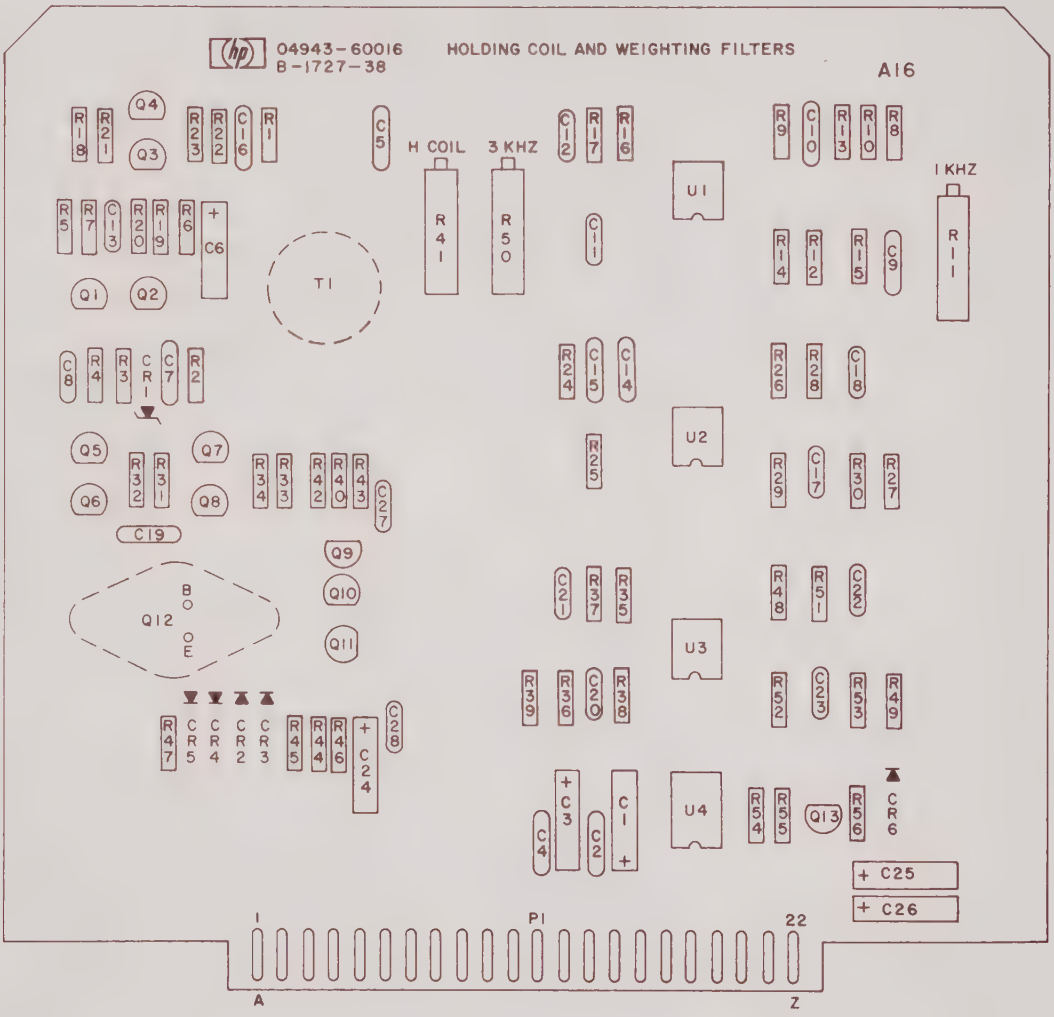


Figure 8-57. A16 Holding Coil and Weighting Filters Component Locator

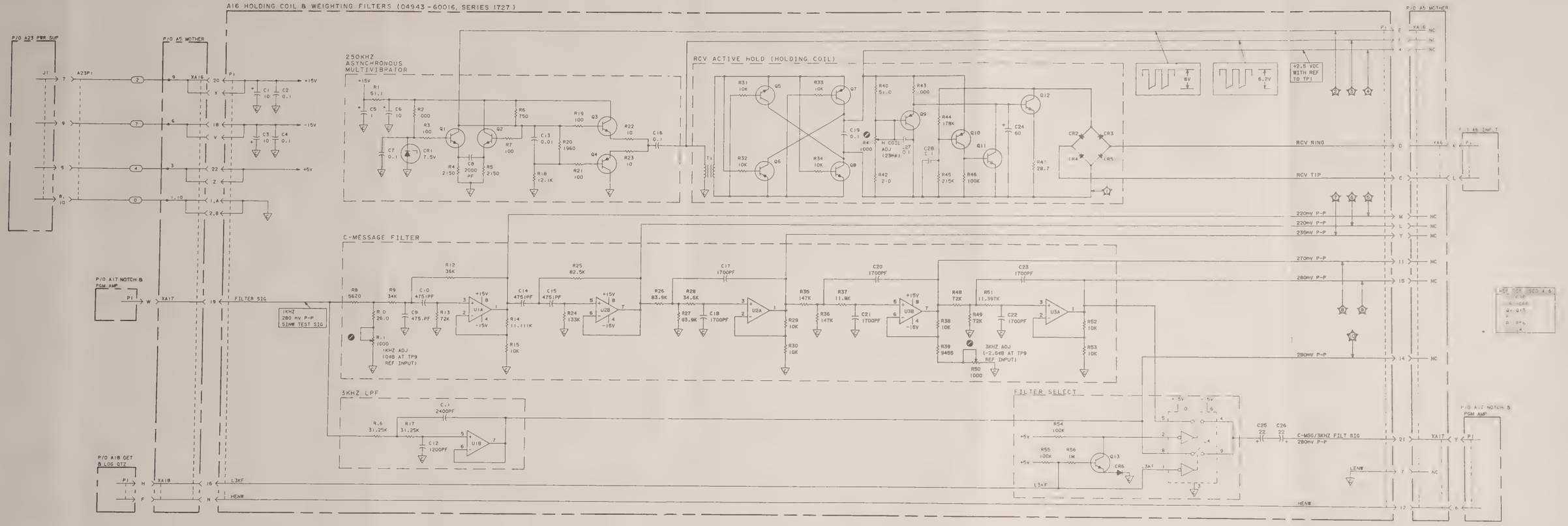


Figure 8-58. A16 Holding Coil and Weighting Filters Schematic Diagram

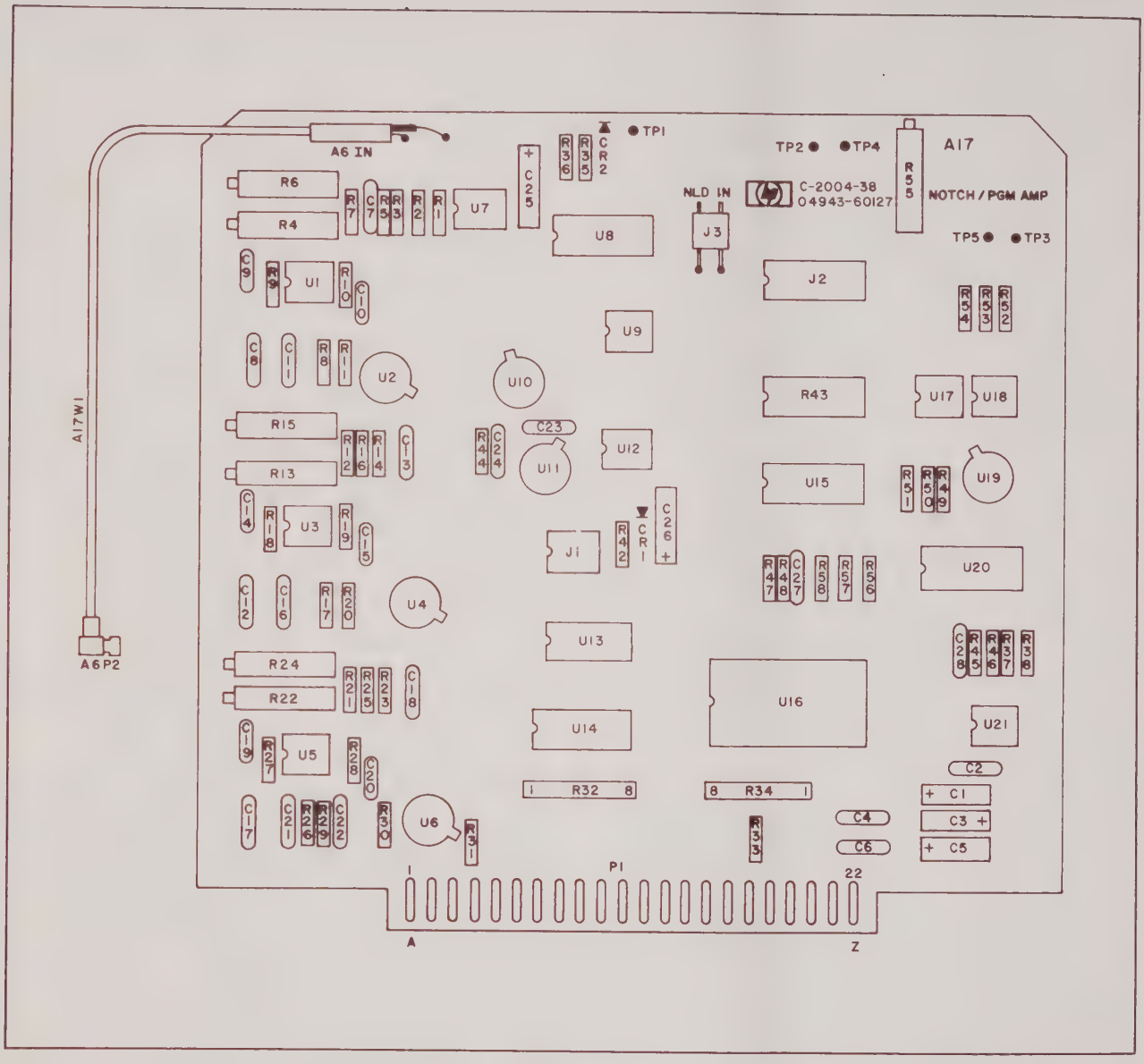


Figure 8-59. A17 Notch Filter and Programmable Amplifier Component Locator

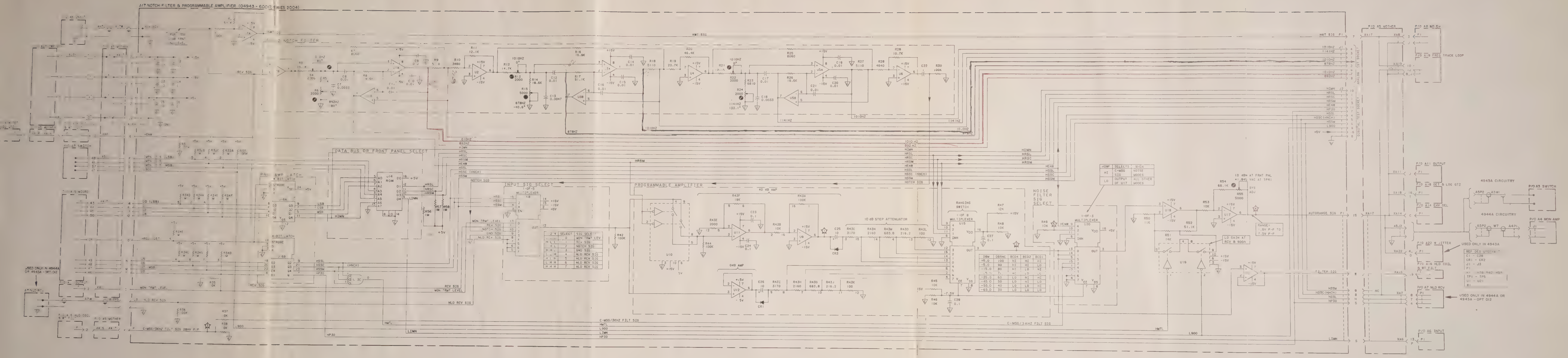


Figure 8-60 A17 Notch Filter and Programmable Amplifier Schematic Diagram

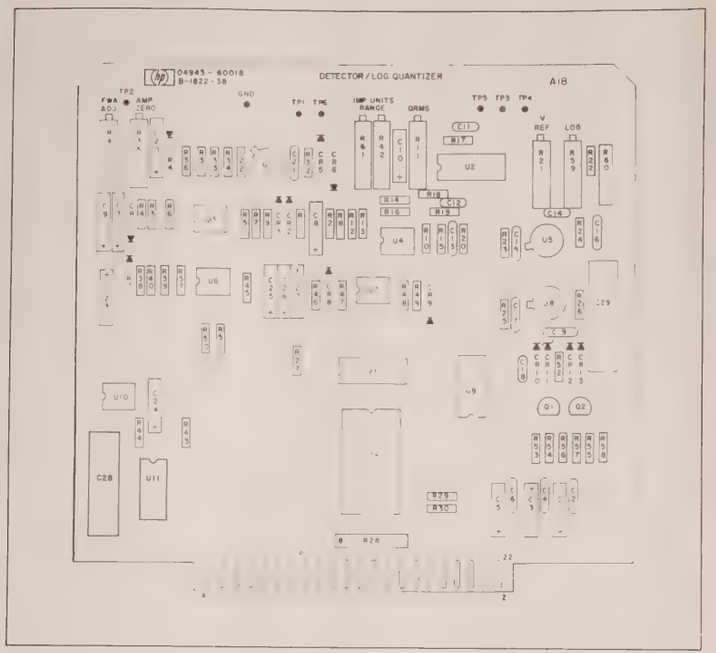


Figure 8-61. A18 Detectors and Log Quantizer Component Locator

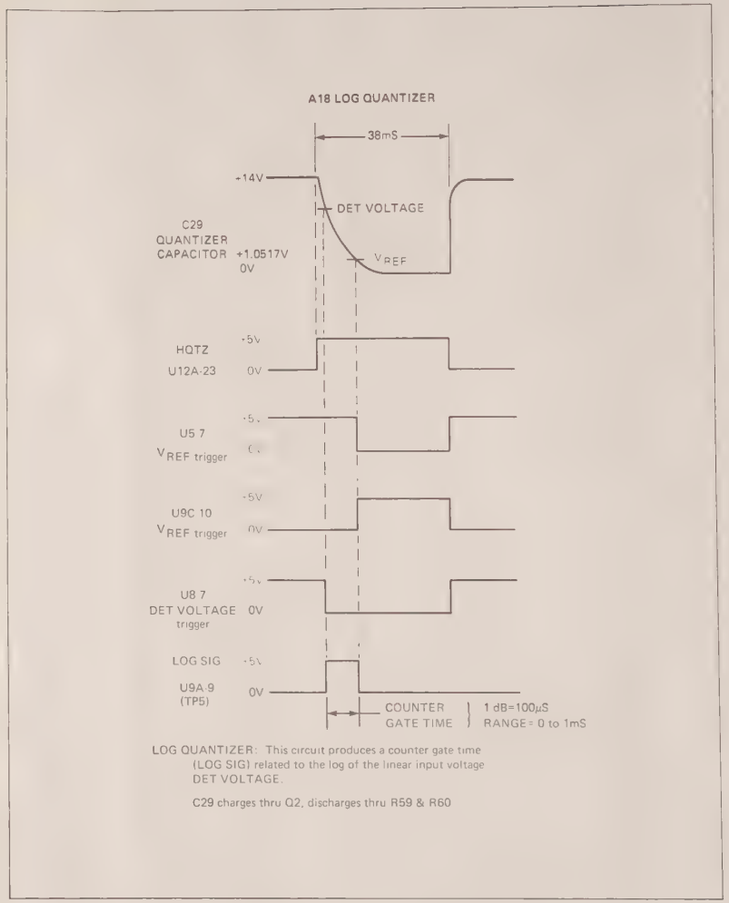


Figure 8-62. Log Quantizer Waveforms

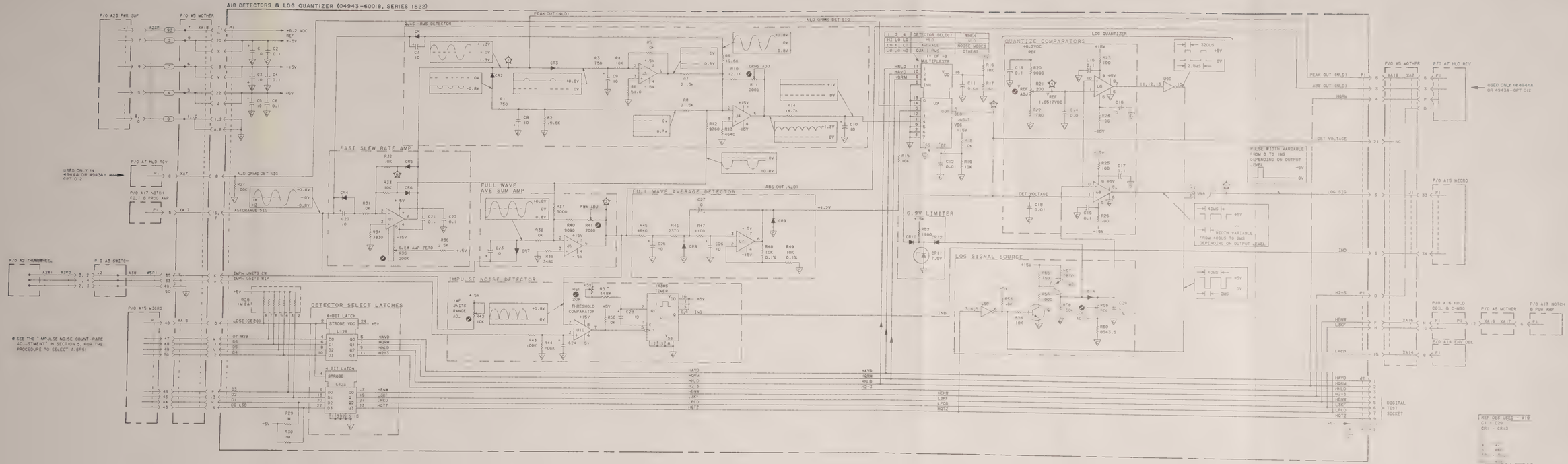


Figure 8-63. A18 Detectors and Log Quantizer Schematic Diagram

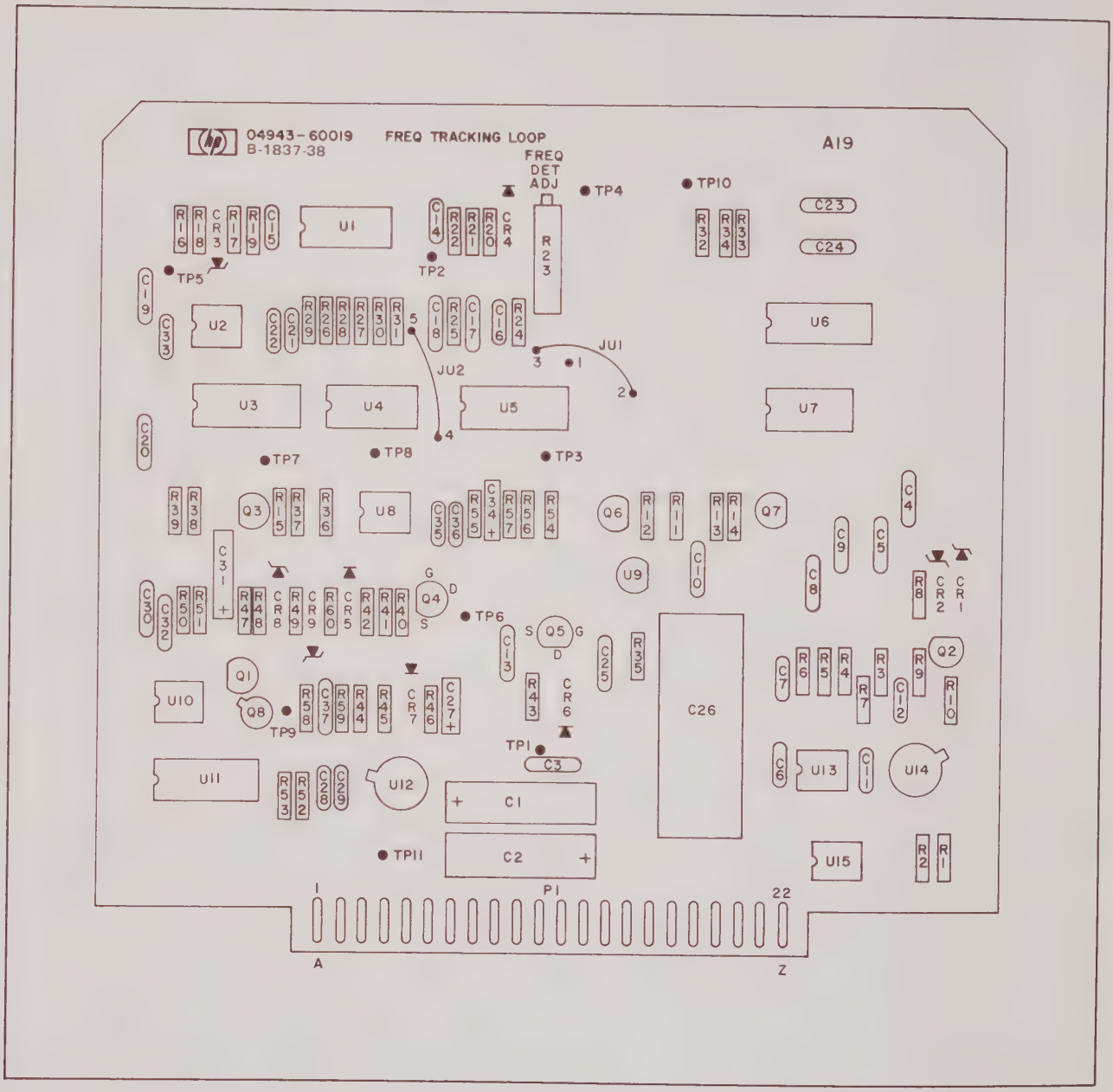


Figure 8-64. A19 Frequency Tracking Loop Component Locator

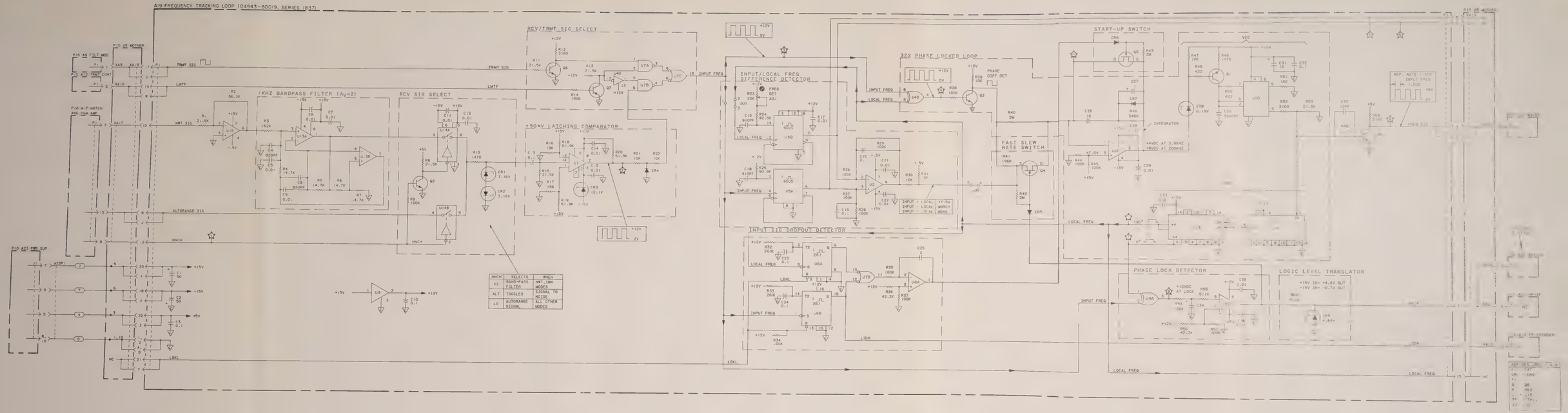


Figure 8-65. A19 Frequency Tracking Loop Schematic Diagram

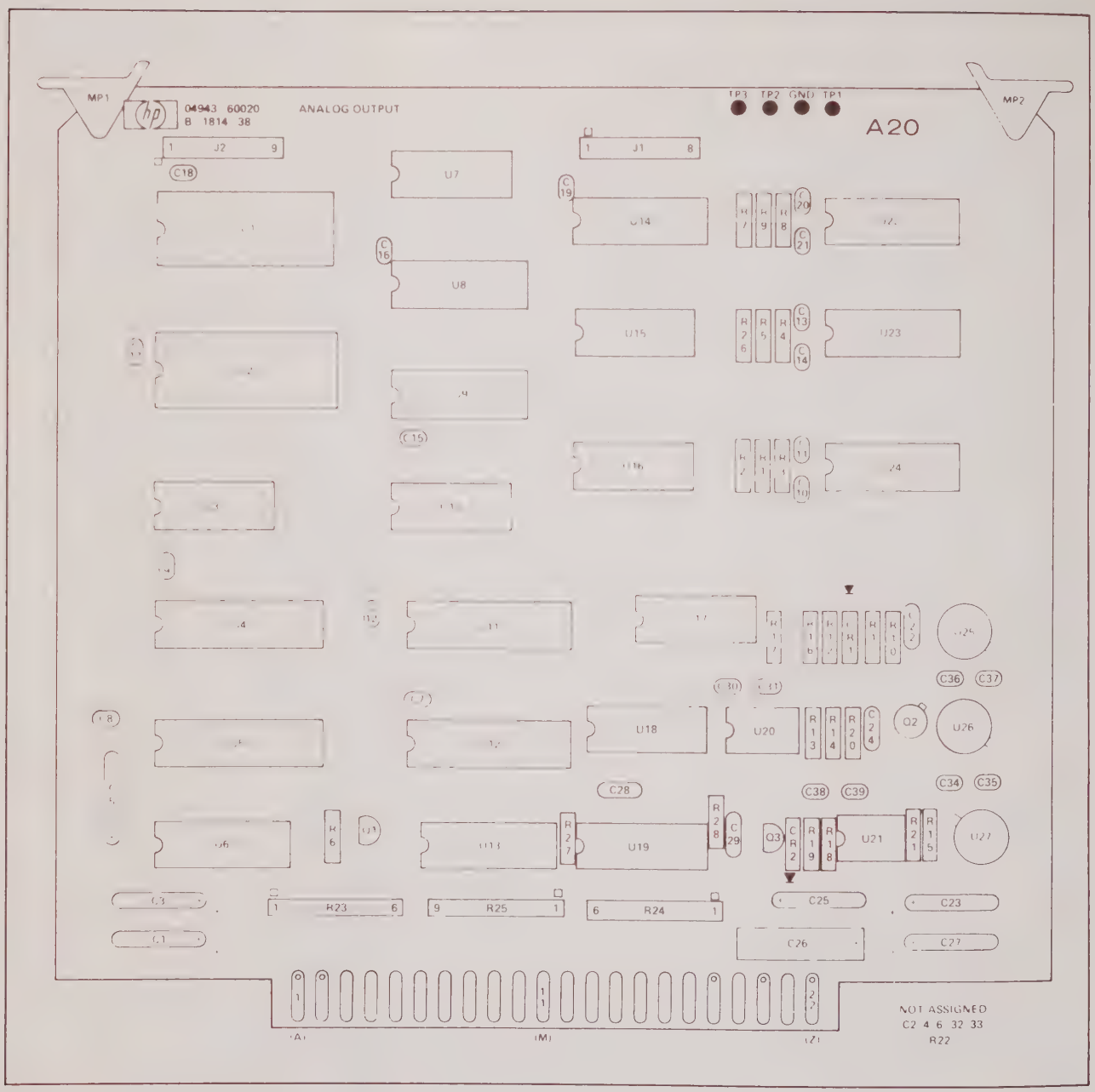


Figure 8-66. A20 Analog Outputs Component Locator

PRINCIPLES OF OPERATION

The following text is a general discussion on the operation of the A20 Assembly. Two figures are included: Figure 3, a simplified block diagram and Figure 4, a schematic diagram.

Digital data inputs to the A20 Assembly are converted to analog voltages by the A20 circuits. These analog outputs are used as drive signals for an x-y plotter and/or an oscilloscope. A circuit within the A20 Assembly automatically calibrates the oscilloscope display to the A20 output, by intensifying the display graticule center-line.

Input data bits from the HP 4943A microprocessor are buffered by U12 and applied to the inputs of y-data latches U4 and U5, x-data latch U11 and graticules control latch U6.

Y-data is clocked and latched on the output side of U5 whenever the $\overline{\text{YANAL}}$ is active. Following this, the x-data is applied to the input of latch U11. Whenever $\overline{\text{XANAL}}$ is active, both U11 and U4 are clocked and both the x-data and y-data are simultaneously latched on the outputs of U11 and U4 respectively.

Outputs from U4 are applied to the y-plot D-to-A converter U24/U27B. Outputs from U11 are applied to the x-plot D-to-A converter U23/U27A. The data inputted to these two DAC's, when processed, produce the x-y plotter analog voltage. U4 data outputs are also applied to address comparator U8 and U9.

The x-data is compared by U8 and U9 with the lower 8-bits (A0-A7) from address generator U3 and U10. When coincidence occurs (x-data is the same as address generator output) U8(6) goes high. When U18(12) is also high, write-enable signal is applied, through U15C, U16B and U7B to RAM's U1 and U2. The y-data is stored in U1, U2 RAM's at a location specified by address generator U3 and U10.

If the x-data inputted to address comparator U8 is not the same as the lower 8-bits from address generator U3 and U10, a write-enable signal is not generated and applied to RAM's U1 and U2. The data outputted by the RAM's is then only data present at the location addressed by address generator U3 and U10 (not stored data). Data from the RAM's is applied to the CRT Vertical D-to-A converter U22.

A second source of data for D-to-A converter U22 is the 256-Bit pROM, U14. This pROM contains stored data needed to generate the graticules on any oscilloscope CRT. Addressing for U14 is done with the upper 3-bits (A0-A2) from address generator U10. These 3-bits form the lower 3-bits of the pROM address. The upper 2-bits (A3, A4) are set by the graticule control latch U6 which is controlled through U12 by the HP 4943A microprocessor. With these 2-bits, four graticule highlight combinations are possible.

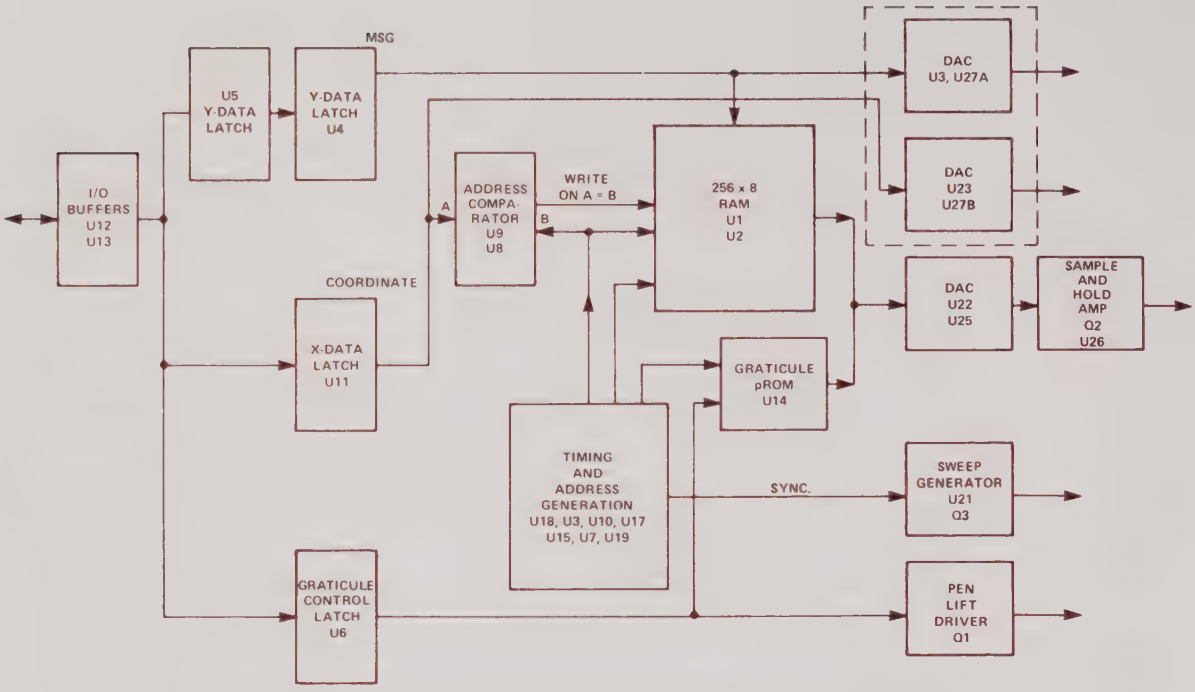
The graticule highlight is the automatic display calibration and is generated by tracing over the same line several times.

Stored RAM data and pre-programmed pROM data are displayed on alternate scans. One of the data-bits from address generator U3 and U10, in conjunction with the timing circuit comprised of parts U7, U15 and U17, selects the appropriate device.

Digital data outputs from the RAM's or pROM are converted by CRT Vertical D-to-A converter U22 to an analog voltage. The analog voltage output from U25A is applied to the Sample and Hold circuit consisting of Q2 and U20. U20 and Q2 are switched by U19A and the voltage level is converted to + and – 15 Vdc, through U25A.

Horizontal Sweep Generator comprised of Q3, U21 and associated components, generates the CRT HORIZontal output. Q3 gates the sweep and and off and U21 amplifies and linearizes the sweep voltage. When Q3 is on, the sweep output stops; when Q3 is off, the sweep output starts.

Timing signals from U15A provide a reset pulse for the sweep circuit. A pen-lift control signal for the x-y plotter is also generated through Q1.



4943A, A20 Analog Output Assy Simplified Block Diagram

Troubleshooting

Signature Analysis capability of the A20 assembly enables failures to be more easily located. Table 2 of this change sheet includes signatures for the major IC's of the A20 assembly. Preliminary set-up for verifying these signatures is as follows and assumes the instrument circuits are exposed: **CAUTION: Do not remove or install any boards unless the HP 4943A operating power is turned OFF.**

1. Obtain an oscilloscope, a Signature Analyzer and a 44-pin extender board. See Table 1-2 in the HP 4943A Operating and Service Manual.

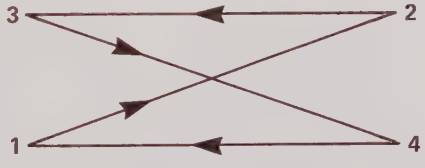
2. Connect VERT output of HP 4943A to the oscilloscope vertical input. Set the oscilloscope for 2 volts dc per division.

3. Connect HORIZ output of HP 4943A to the oscilloscope TRIG and HORIZ External INPUT. Set oscilloscope controls for External display, AC coupled.

4. Turn HP 4943A POWER switch to on.

5. Set the HP 4943A into SELF CHECK mode with MEASUREMENT switch set to IMPULSE NOISE. Refer to the instruments' Operating and Service Manual, Figure 3-2 for Self-Check information.

6. Oscilloscope display should be a moving pattern similar to the following figure and moving in the sequence indicated:



Oscilloscope Pattern

NOTE

The highlighted graticule line should also move through the four center lines of the graticule. The graticule lines should be equally spaced throughout the display.

7. Turn HP 4943A POWER to OFF and install A20 onto a 44-pin extender board.

8. Connect Signature Analyzer leads as follows:

   START to A15-S3
   STOP to A15-S4
   CLOCK to A15-CLK 2

   Connect a jumper wire from A15-S3 to A20TP3.

9. Set Signature Analyzer controls as follows:

   LINE to ON
   START to ⌐¬
   STOP to ⌐¬
   CLOCK to ¬⌐
   HOLD to Out.

10. Check the characteristic A20 5 volt signature to verify set-up.

11. Use the A20 schematic diagram and Table 2 to follow signal flow/signatures through the A20 circuits.

NOTE

First signatures may be unstable. Wait for two or three successively identical signatures at each node.

A20 Signature Analysis

U1 PINS	SIGNATURE	U2 PINS	SIGNATURE
1	0276	1	0276
2	5CCO	2	5CCO
3	F58H	3	F58H
4	OFUU	4	OFUU
5	8C92	5	8C92
6	2A39	6	2A39
7	5324	7	5324
8	GND	8	GND
9	CCP8	9	90A6
10	571F	10	25PO
11	A898	11	UO55
12	AH33	12	OA2H
13	1240	13	CH4C
14	HH30	14	8627
15	P86A	15	C8U1
16	OFP9	16	PO2P
17	+5	17	+5
18	47AC	18	47AC
19	GND	19	GND
20	A71U	20	A71U

U3 PINS	SIGNATURE	U4 PINS	SIGNATURE
1	0276	1 +5	–
2	0000	2	CH4C
3	4P30	3	7A97
4	8C92	4	214F
5	2A39	5	90A6
6	5324	6	1240
7	GND	7	2480
8	–	8	77H1
9	–	9	CCP8
10	–	10 GND	–
11	–	11	06P9
12	GND	12	A898
13	GND	13	5131
14	+5	14	H0H4
		15	P86A
		16	UO55
		17	POAC
		18	71P2
		19	C8U1
		20 (+5)	–

A20 Signature Analysis (Continued)

U5 PINS	SIGNATURE	U6 PINS	SIGNATURE
1 +5	–	1 +5	–
2	7A97	2	0000
3	C5U6	3	–
4	U5CA	4	1934
5	214F	5	P2UH
6	2840	6	–
7	FP4H	7	0000
8	1934	8 GND	–
9	77H1	9	A71U
10 GND	–	10	A71U
11	P4U2	11	–
12	5131	12	FP4H
13	P2UH	13	1612
14	1612	14	–
15	H0H4	15	A71U
16	POAC	16 +5	–
17	5715		
18	8HF1		
19	71P2		
20 +5	–		

U7 PINS	SIGNATURE	U8 PINS	SIGNATURE
1	9151	1	APOO
2	OAF9	2 GND	–
3	695C	3	P749
4	A71U	4 GND	–
5	A71U	5	–
6	A71U	6	313A
7	– GND	7	–
8	OAF9	8 GND	–
9	8C92	9	U1A6
10	4P30	10	4P30
11	9151	11	F99F
12	5324	12	8C92
13	2A39	13	2A39
14	+5	14	9F75
		15	5324
		16 +5	–

A20 Signature Analysis (Continued)

U9 PINS	SIGNATURE	U10 PINS	SIGNATURE
1	9HCA	1	F3P6
2 GND	–	2	0000
3 +5	–	3	OFUU
4 GND	–	4	F58H
5	–	5	5CCO
6	P7U9	6	0276
7	–	7	GND
8 GND	–	8	791U
9	7HPC	9	27H9
10	OFUU	10	P854
11	AH5C	11	1H79
12	F58H	12	0000
13	5CCO	13	5324
14	9U06	14	+5
15	0276		
16 +5	–		

U11 PINS	SIGNATURE	U12 PINS	SIGNATURE
1 (+5)	–	1 GND	–
2	9F75	2	8HF1
3	C5U6	3	C5U6
4	U5CA	4	5715
5	U1A6	5	U5CA
6	9U06	6	1612
7	FP4H	7	FP4H
8	1934	8	P2UH
9	7HPC	9	1934
10 GND	–	10 GND	–
11	06P9	11	1934
12	AH5C	12	P2UH
13	P2UH	13	FP4H
14	1612	14	1612
15	9HCA	15	U5CA
16	F99F	16	5715
17	5715	17	C5U6
18	8HF1	18	8HF1
19	APOO	19 +5	–
20	+5	20 +5	–

A20 Signature Analysis (Continued)

U13 PINS	SIGNATURE	U14 PINS	SIGNATURE
1	A71U	1	571F
2	0000	2	AH33
3	1934	3	HH30
4	A71U	4	OFP9
5	P2UH	5	25PO
6	A71U	6	OA2H
7	FP4H	7	8627
8 GND	–	8	GND
9	8HF1	9	PO2P
10	0000	10	P854
11	–	11	27H9
12	–	12	791U
13	–	13	0000
14	–	14	0000
15	–	15	POC4
16 +5V	–	16	+5

U15 PINS	SIGNATURE	U16 PINS	SIGNATURE
1	0000	1	FP4H
2	F3P6	2	FP4H
3	695C	3	0000
4	0276	4	0000
5	4FOH	5	0000
6	7203	6	A71U
7	GND	7	GND
8	2372	8	
9	791U	9	NOT USED
10	27H9	10	
11	P854	11	POC4
12	0000	12	47AC
13	313A	13	47AC
14	+5	14	+5

U17 PINS	SIGNATURE	U18 PINS	SIGNATURE
1	7203	1 +5	–
2	9PH6	2	–
3	47AC	3	GND
4	5CCO	4	GND
5	F58H	5	–
6	4FOH	6	0000
7	GND	7	GND
8		8 +5	–
9	NOT USED	9	–
10		10	GND
11	9PH6	11	GND
12	2372	12	F3P6
13	1H79	13	FP4H
14	+5	14	+5

A20 Signature Analysis (Continued)

U19 PINS	SIGNATURE	U22 PINS	SIGNATURE
1	–	1	GND
2	–	2	GND
3	–	3	-15
4	–	4	–
5	–	5	P02P
6	–	6	8627
7	–	7	OA2H
8	–	8	25PO
9	F3P6	9	OFP9
10	–	10	HH30
11	–	11	AH33
12	–	12	571F
13	–	13	+5
14	–	14	–
15	–		
16	–		

U23 PINS	SIGNATURE	U24 PINS	SIGNATURE
1 GND	–	1 GND	–
2 GND	–	2 GND	–
3 - 15	–	3 - 15	–
4	–	4	–
5	APOO	5	C8U1
6	9F75	6	CH4C
7	F99F	7	4055
8	U1A6	8	U0A6
9	9HCA	9	P86A
10	9U06	10	1240
11	AH5C	11	A898
12	7HPC	12	CCP8
13 +5V	–	13 +5V	–
14	–	14	–

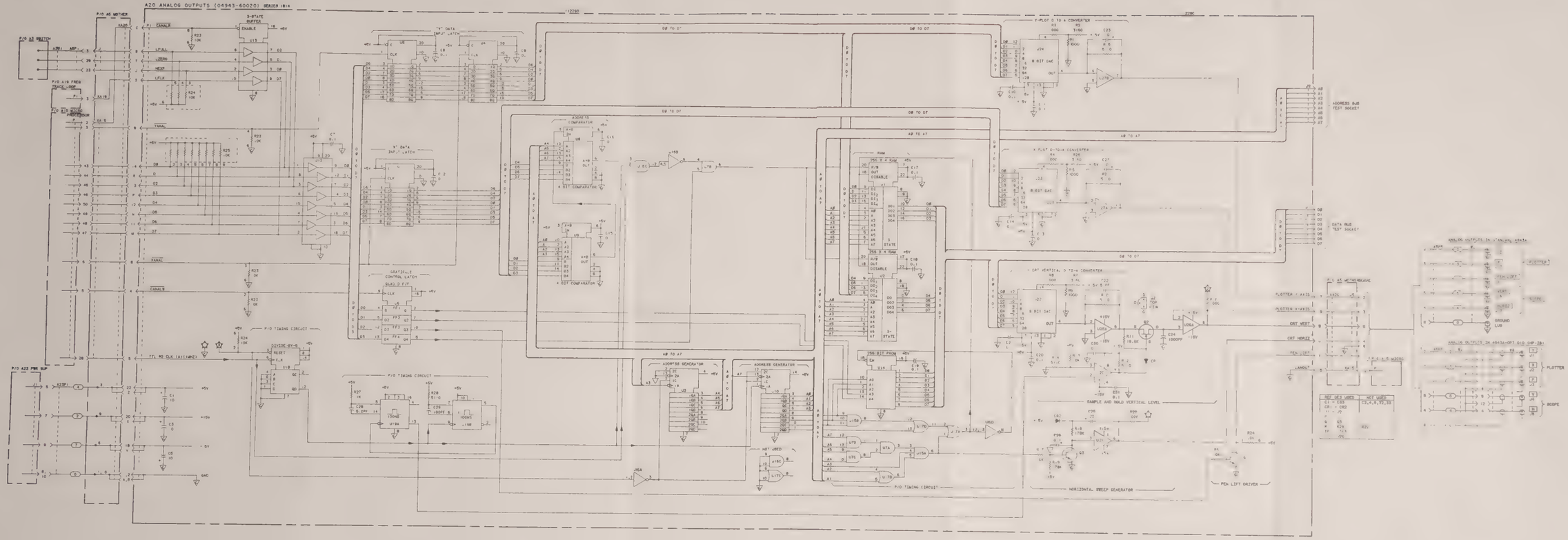


Figure 8-67. A20 Analog Outputs Schematic Diagram

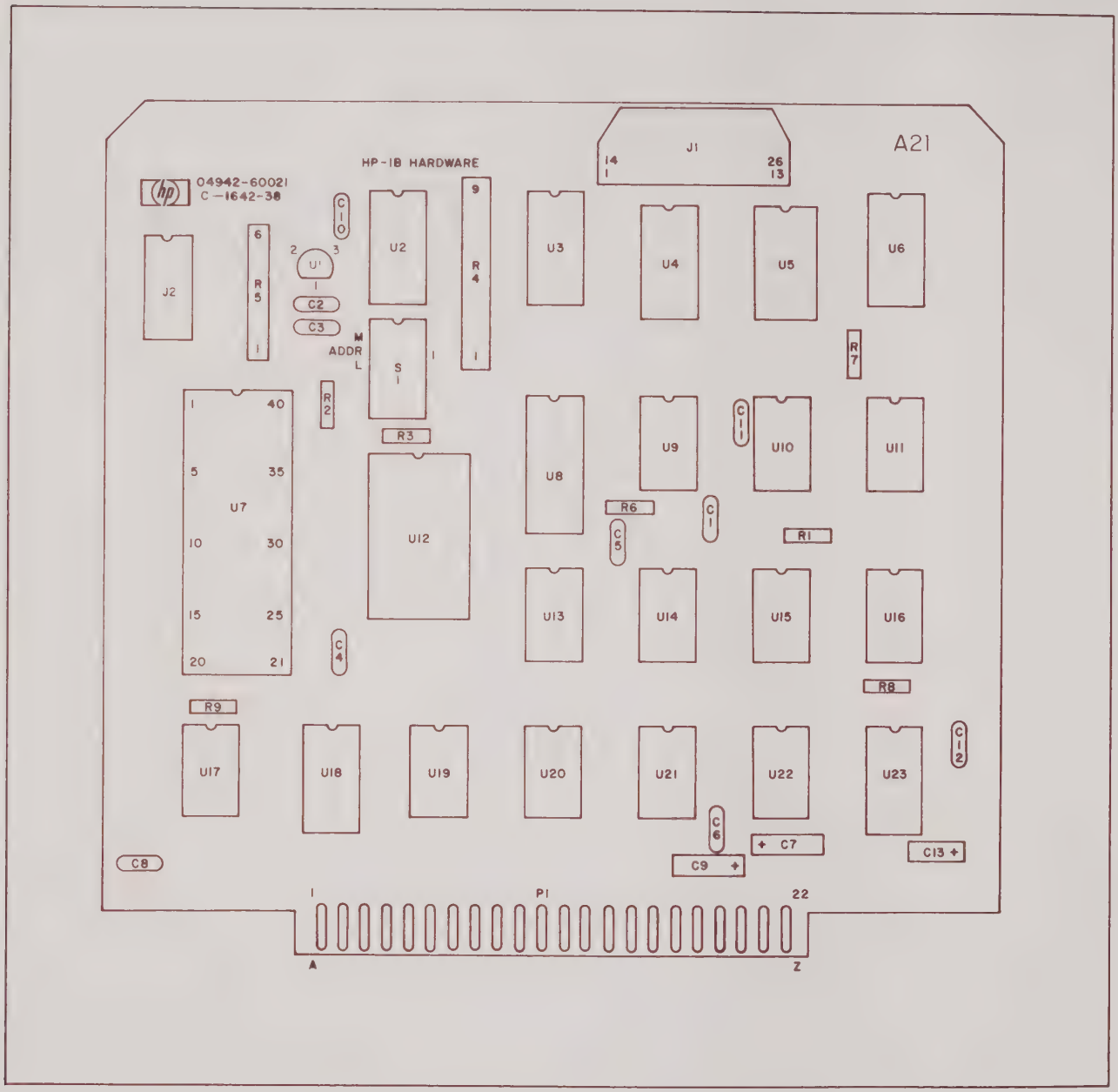


Figure 8-68. A21 HP-IB Component Locator

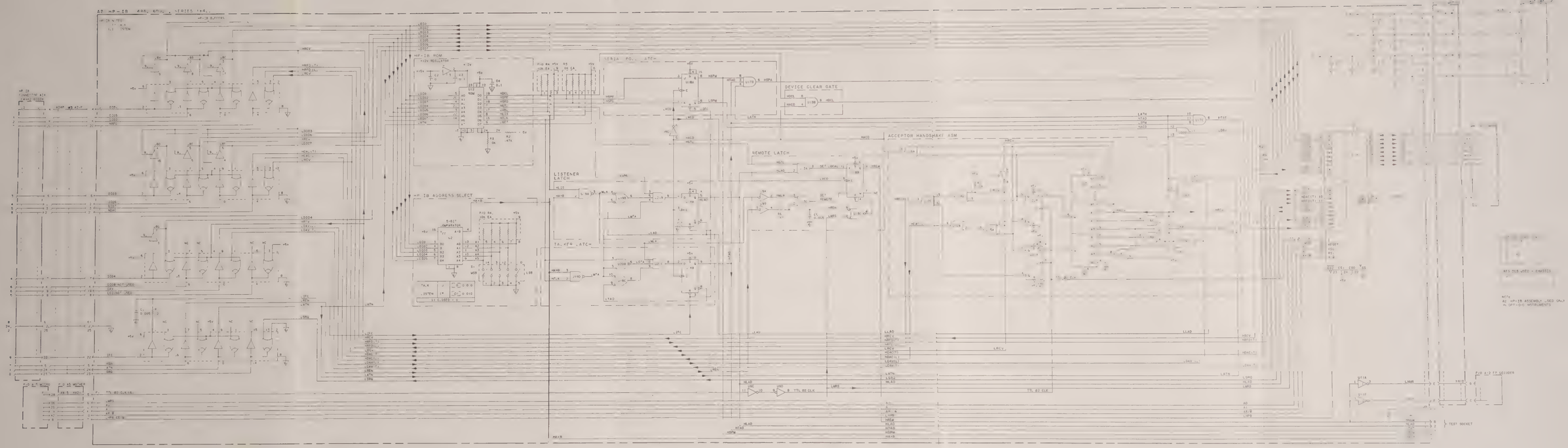


Figure 8-69. A21 HP-IB Schematic Diagram

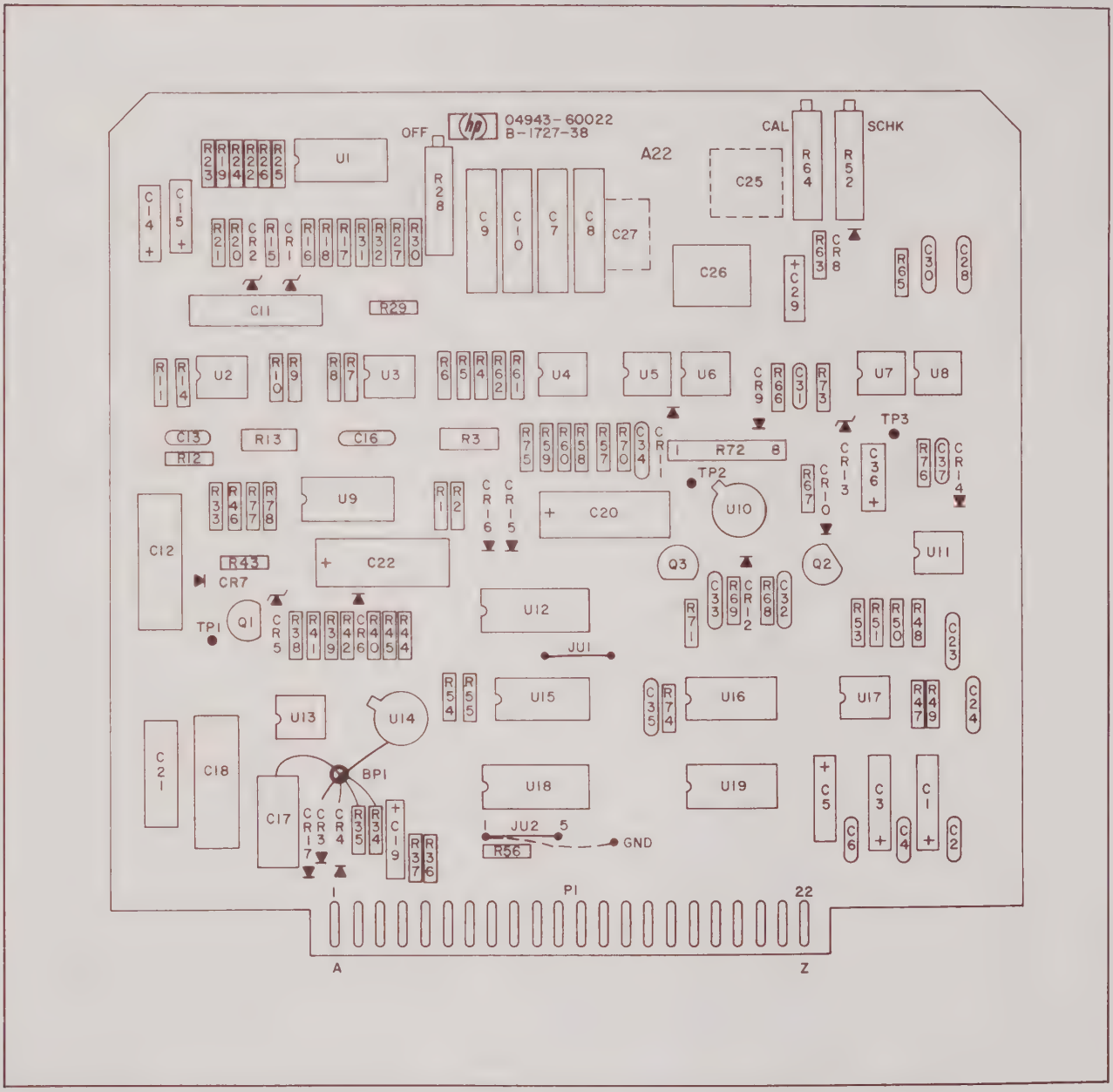


Figure 8-70. A22 Phase Jitter Component Locator

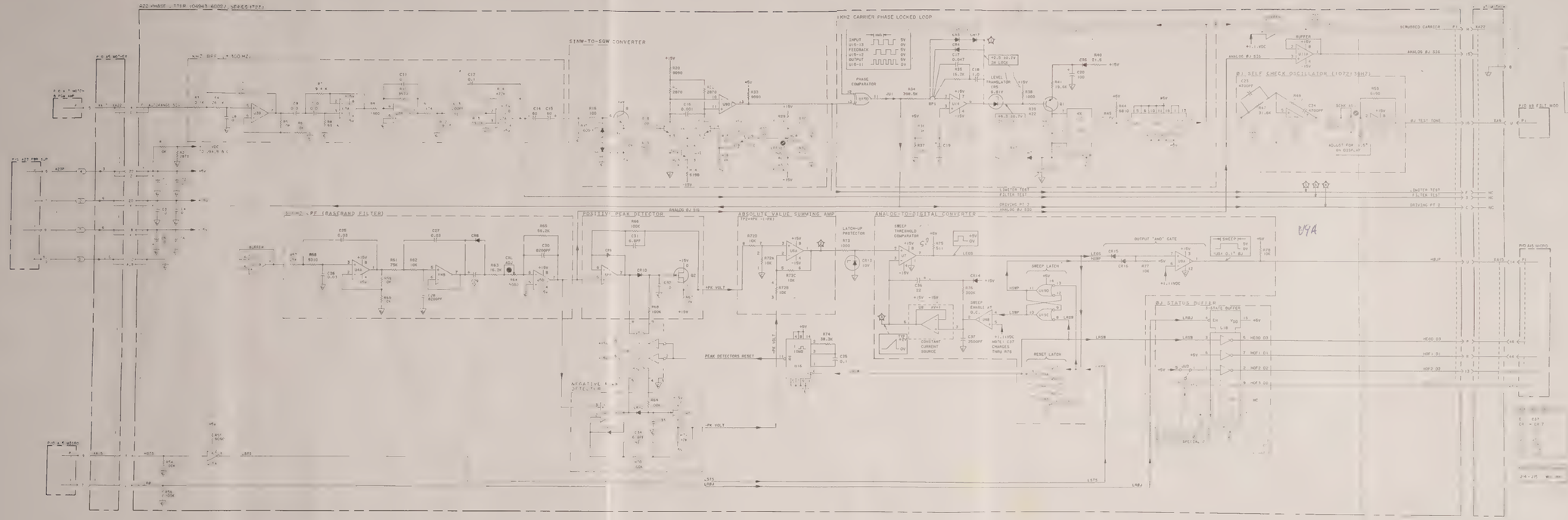


Figure 8-71. A22 Phase Jitter Schematic Diagram

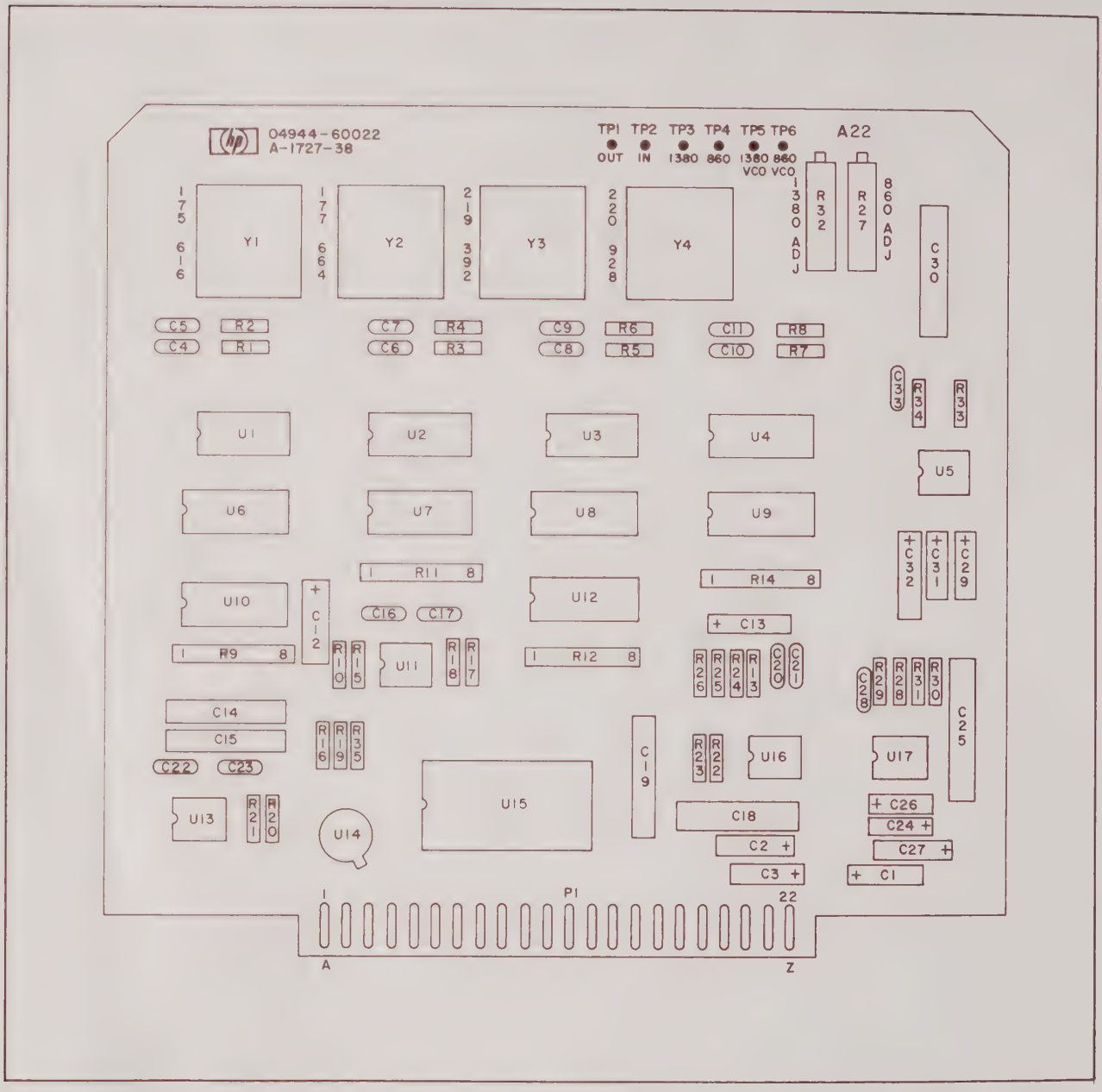


Figure 8-72. A22 Nonlinear Distortion Transmitter Component Locator (Option 012)

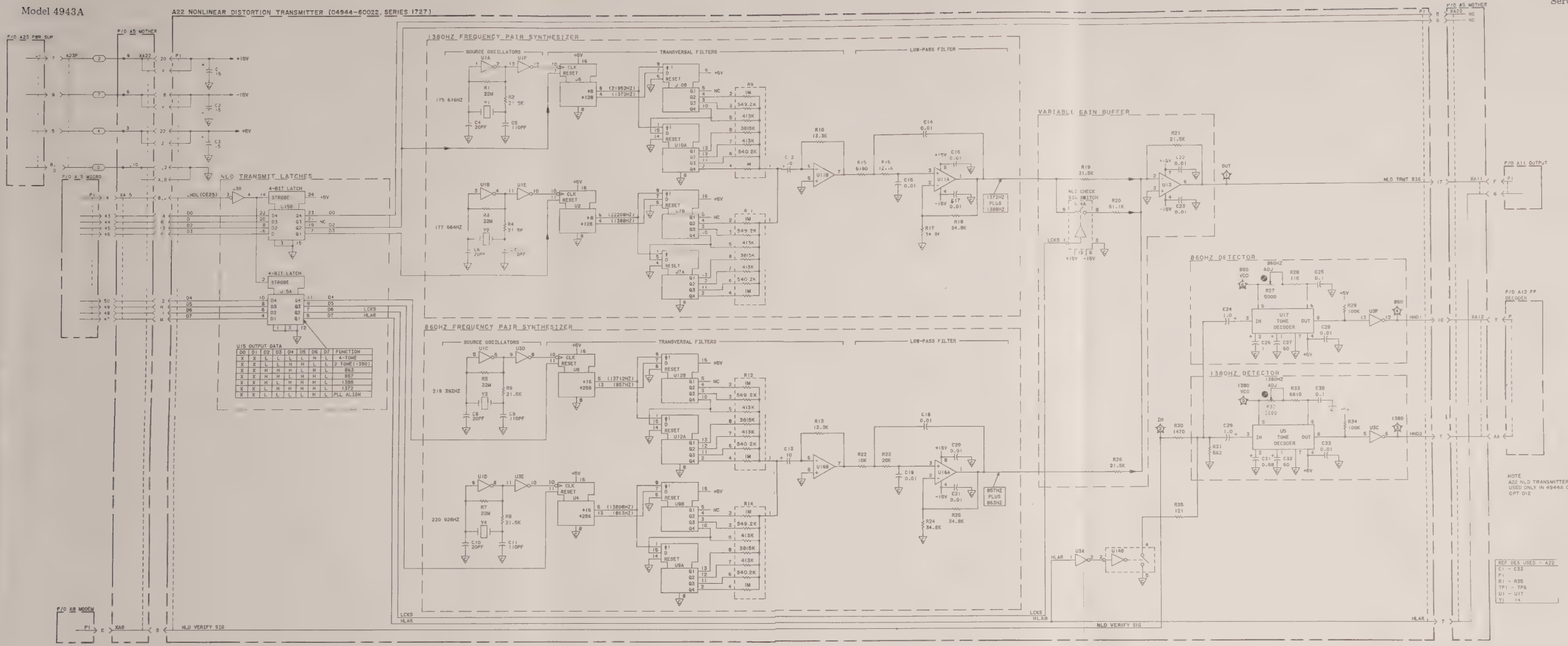


Figure 8-73. A22 Nonlinear Distortion Transmitter Schematic Diagram (Option 012)

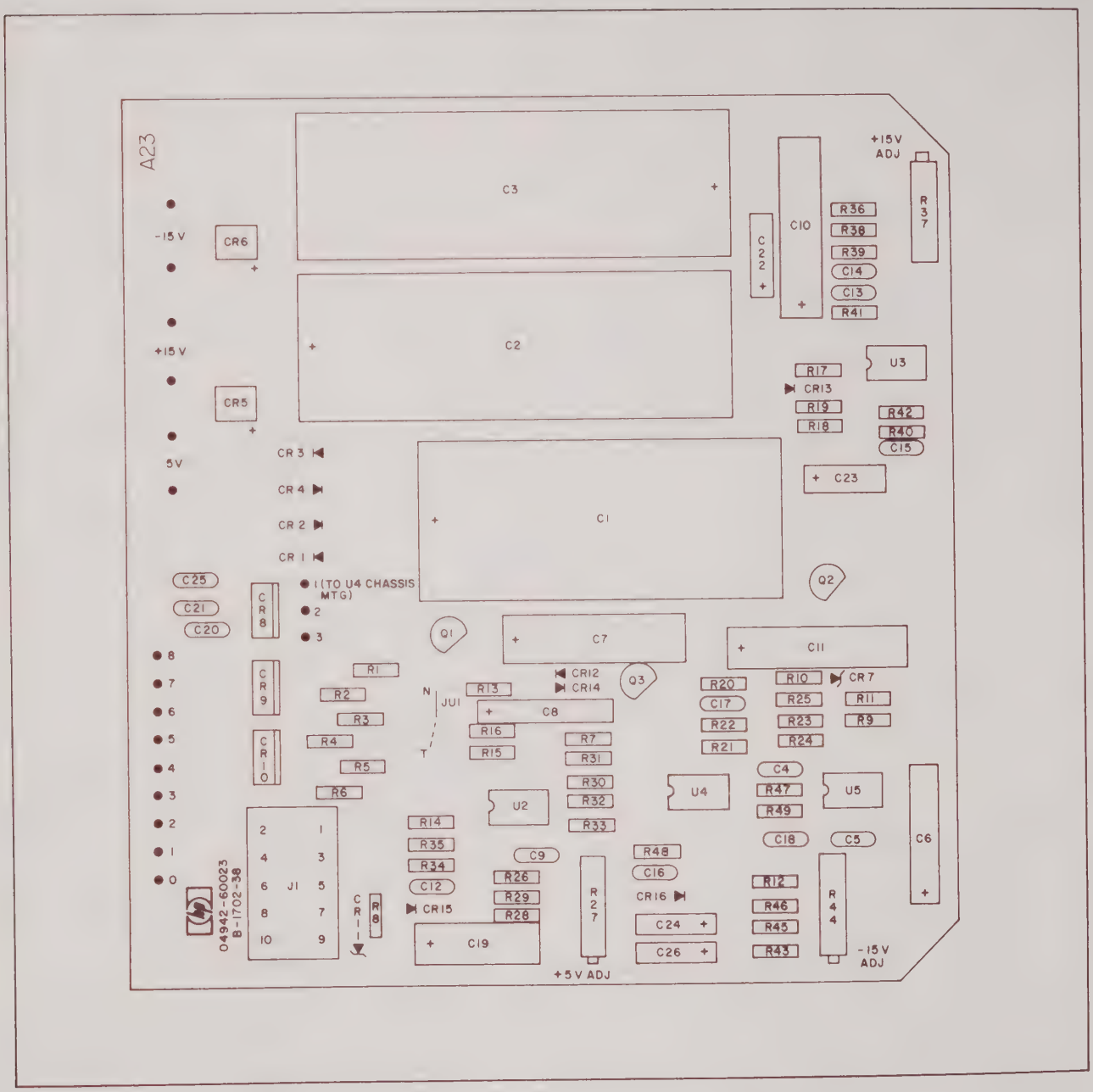


Figure 8-74. A23 Power Supply Component Locator

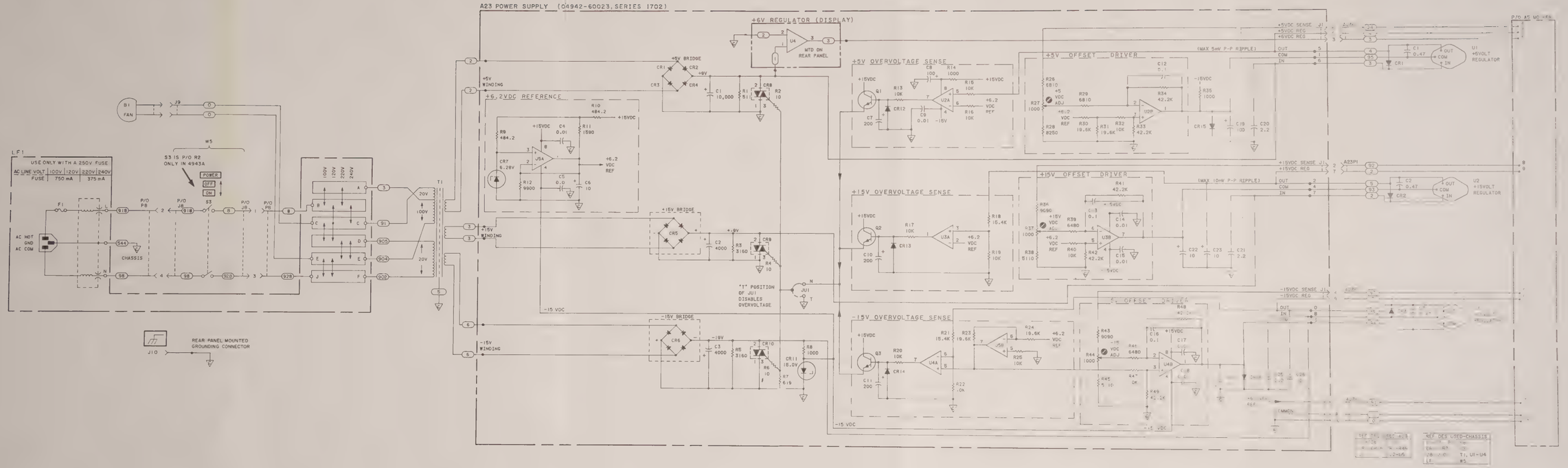


Figure 8-75. A23 Power Supply Schematic Diagram

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Arranged alphabetically by country

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SANTIAGO 9
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Olympia (Chile) Ltd.
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Tel: 225-5044
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C,P

CHINA, People's Republic of

CEIEC Inc.
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COLOMBIA

Instrumentación
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E,M,P

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M

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International Engineering Associates
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Telex: 93830
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P

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F-38320 **EYBENS**
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Hewlett-Packard France
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Blue Star Ltd.
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Telex: 60605
A,M

Northrop Instruments & Systems Ltd.
110 Mandeville St.
P.O. Box 8388
CHRISTCHURCH
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Telex: 4203
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Northrop Instruments & Systems Ltd.
Sturdee House
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WELLINGTON
Tel: 850-091
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NORTHERN IRELAND
Cardiac Services Company
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***BELFAST** BT 10 OBY*
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M

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N-5033 **FYLLINGSDALEN** (BERGEN)
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OMAN
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P

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Mushko & Company Ltd.
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Cable: FEMUS Rawalpindi
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Telex: 2894 MUSKO PK
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Electrónico Balboa, S.A.
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Edificio "Alfa" No. 2
CIUDAD DE PANAMA
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Telex: 0383 ELECTRON PG
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690-B Epifanio de los Santos Avenue
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P.O. Box 2649 Manila
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P

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Telectra-Empresa Técnica de Equipmentos Eléctricos S.a.r.l.
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M

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Cable ELECTA AL-KHOBAR
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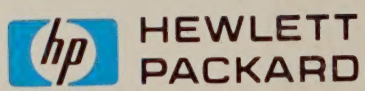

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